High Speed Water Transit Study for the San Francisco Bay Area

MTC
METROPOLITAN TRANSPORTATION COMMISSION

METROCENTER
101 8TH STREET
OAKLAND, CA 94607
(415) 464-7700

April 1985

THE COVER:

Design by Michael Fram.

Depicted on the cover are two types of high speed water transit vessels that are currently operating on the San Francisco Bay. They are a Surface Effect Ship (SES) and a catamaran. A smaller version of the SES shown is being operated by Harbor Bay Isle on a 12-month demonstration project between the Harbor Bay Business Park in Alameda and San Francisco. The catamaran is being operated by Red & White Fleet between Tiburon/Sausalito and San Francisco. Not shown are the fully amphibious air cushion vehicle or the hydrofoil which are also proposed for Bay operations.

HIGH SPEED WATER TRANSIT STUDY

for the San Francisco Bay Area

by

Natalie McConnell

Shanna O'Hare

published by

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Planning Section
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MTC was created by the California State Legislature in 1970 as the regional transportation planning agency for the San Francisco Bay Area. The nine counties of this region are Alameda, Contra Costa, Marin, Napa, Santa Clara, San Francisco, San Mateo, Solano, and Sonoma.

Policy direction is provided by 18 Commissioners. Fourteen members are appointed directly by locally elected officials, two members represent other regional agencies (the Association of Bay Area Governments and the Bay Conservation & Development Commission), and two non-voting members represent state and federal transportation agencies.

Participating Staff

Paul F. Maxwell, Manager, Planning

Dennis R. Fay, Project Director

Natalie McConnell, Author

Shanna O'Hare, Author

Peter Beeler, Graphic Artist

Michael Fram, Graphic Artist

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I. INTRODUCTION

In July, 1984, the Metropolitan Transportation Commission (MTC) received presentations from five individuals who were proposing high speed water transit (HSWT) services on the San Francisco Bay. In response to these proposals, staff was directed to undertake a study of high speed water transit. The study commenced in August and was subdivided into five tasks, each of which is covered as a separate chapter of this report. The five tasks are:

1. Overview of current HSWT technology;
2. Review of existing HSWT services worldwide;
3. Documentation of Bay Area water transit proposals;
4. Analysis of legal and institutional considerations;
5. Analysis of the Bay Area proposals

The five proposals for water transit service on the Bay that were received and documented include:

- Harbor Bay Isle Associates (HBI) - service between the City of Alameda and San Francisco;
- Forum Hydrolines, Dr. Nicolas Hetzer - four routes from San Rafael to San Francisco, Alameda to San Francisco, San Francisco Airport to Oakland Airport and Pittsburg to San Francisco;
- Marin County Supervisor Robert Roumiguiere - service from Marin County to San Francisco;
- Pacific Transportation Systems - service from San Jose to Oakland Airport, San Francisco Airport, and Downtown San Francisco;
- Pittsburg Chamber of Commerce - service from Pittsburg to Martinez to San Francisco.

Chapter IV of the report contains summary sheets with maps describing each of the proposals. The five proposals were in various stages of readiness. A complete range of high speed vessel technologies was proposed, including catamaran, hydrofoil, surface effect ships, and hovercraft. Of the five proposals, two were proposing some form of public subsidy -- the Pittsburg Chamber of Commerce's proposal for service from Pittsburg to San Francisco, and Supervisor Roumiguiere's proposal for service from San Pablo Bay to San Francisco. Harbor Bay Isle may be looking for public subsidy at some point in the future, but at this point they are still in the process of formulating their plan.

For completion of Task 5, Analysis of Bay Area proposals, staff conducted two levels of analysis for the five proposals. The first level consisted of a comparison of travel times and fares with alternative transportation modes in the corridor. Existing, connecting, transit service was also examined -- as well as other factors affecting the viability of the service, such as channel depth or related legal issues. All five proposals received this initial level of analysis.

The second level of analysis examined travel demand in the corridor, and projected potential patronage for the proposed service, both for 1980 (had high speed water transit service existed) and for the year 2000. Only the two proposals which have indicated that a public subsidy would be required received the second level of analysis. These two proposals are Marin County Supervisor Roumiguiere's proposed service from Marin County to San Francisco, and the Pittsburg Chamber of Commerce's proposal for service from Pittsburg to Martinez and San Francisco. A profit and loss statement was also prepared for the Marin Corridor showing relative costs of high speed water transit and bus service.

Information used in the preparation of this report consisted of the recently released 2-year study of high speed waterborne transit by the Urban Mass Transportation Administration (UMTA), supplemental data from manufacturers of HSWT vehicles, information from the individual proposers and Bay Area water transit operators. For the patronage projection analysis (Task 5), MTC relied on data from the 1980 Census and the Association of Bay Area Government's Projections '83.

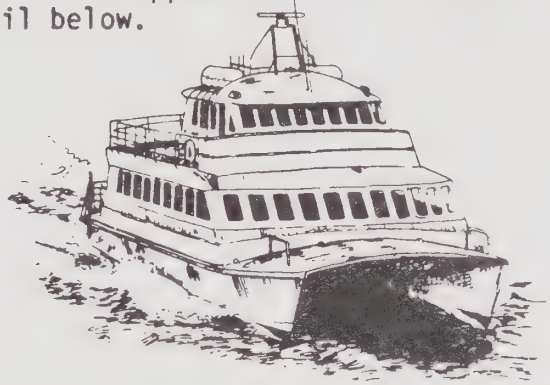
At its February 1985 meeting, the Metropolitan Transportation Commission unanimously approved the final report for this study.

II. TECHNOLOGY REVIEW

INTRODUCTION

Three primary high speed passenger vessel technologies are used throughout the world: catamaran, hovercraft and hydrofoil. To be considered "high speed," a craft must have a calm water speed of over 25 knots, roughly double that of conventional ferries. Each of these technologies was extensively examined in the recent Urban Mass Transportation Administration (UMTA) high speed waterborne transit study[1]. The UMTA report, supplemented with information from manufacturers, provided the background for this section. Figure 1 provides a schematic comparison of the three primary technologies. Table 1 contains a representative sample of vessels including information on capital cost, passenger capacity, draft, cruising speed, hourly operating costs, and availability of U.S. made vessels. While every attempt has been made to keep the data on the various technologies consistent, the level of detail varies depending upon information available. Additional information on these vessels is contained in the Appendix. Each of these three technologies is described in more detail below.

CATAMARANS



The catamaran is characterized by twin hulls and interior spaciousness. These vessels are driven by propellers powered by diesel engines and have a cruising speed of 26-30 knots. Steerage is provided by rudders. The International Catamaran design is currently being manufactured in the United States by Nichols Brothers of Washington State. Westamarin A/S of Norway, the largest manufacturer of catamarans worldwide, is presently investigating the possibility of licensing a west coast shipyard to build its catamarans. Both the capital and operating costs of the catamaran are relatively low when compared to other high speed vessels. The capital cost of a Nichols Brothers 400 passenger catamaran is about $1.8 million and the estimated hourly operating cost is $120. The catamaran is reported to have both a smooth and quiet ride. It has a relatively shallow five foot draft.

Crowley Maritime's Red & White Fleet has recently begun catamaran service between San Francisco and Tiburon using a 200 passenger Nichols Brothers vessel. Both Red & White Fleet and Blue and Gold Lines have ordered 400 passenger Nichols Brothers catamarans for Bay operations to begin in the spring or early summer. Worldwide, over 100 high speed catamarans have been constructed.

HOVERCRAFT

Hovercraft are classified into two types, the fully amphibious air cushion vehicle and surface effect ships.

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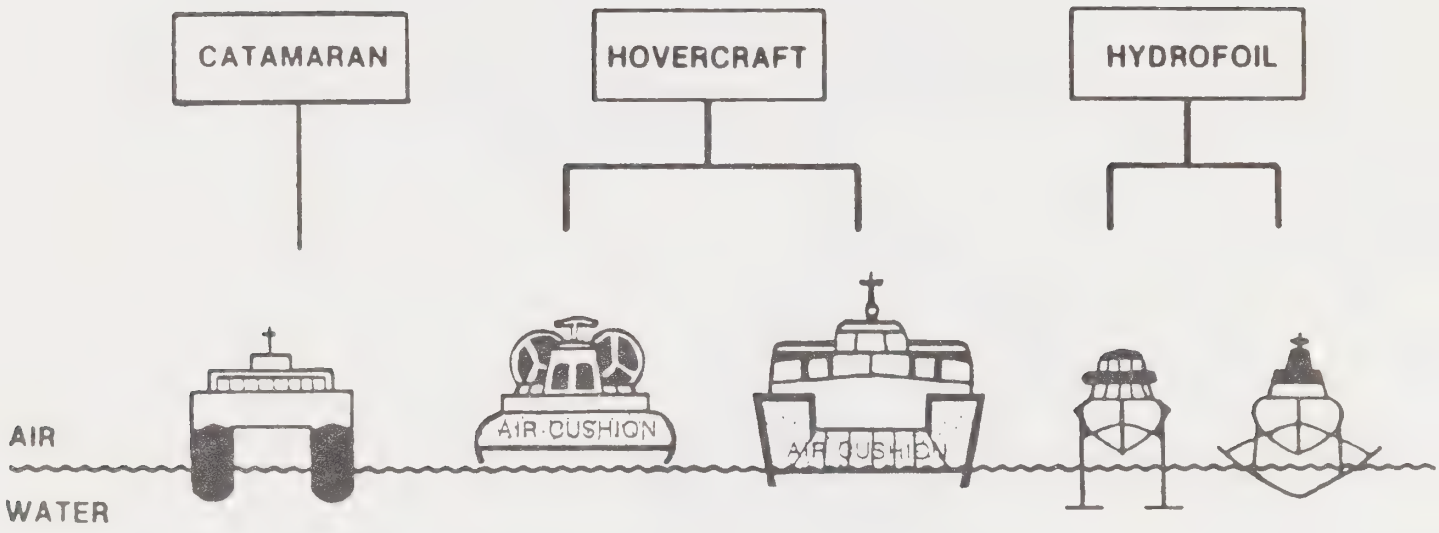
[1] Analysis of High Speed Waterborne Transportation Services Worldwide, Urban Mass Transportation Administration, September 1983.

Figure 1

HIGH SPEED WATER VEHICLES



AIR CUSHION VEHICLE — ACV

SURFACE EFFECT SHIP — SES

SUBMERGED FOILS

SURFACE PIERCING

Table 1
Selected Vehicle Costs and Capacities

Vessel	Manufacturer	Model	Calm Water Cruising Speed (Knots)	Passenger Capacity	Draft Loaded (Rounded up in Feet)		Initial Cost (Millions)	Estimated[1] Operating Costs ($/Oper.Hr.)	U.S. Made
Catamaran	Nichols Brothers[b]	85'	30	400	5		1.8	120	In Production
					Off Cushion	On Cushion			
Air Cushion Vehicles	British Hovercraft[a]	AP-188	40	94	1	N/A	2.5	165	U.S. Licensee Being Sought
	RMI[b]	AVC-80	50[2]	120	1	N/A	2.5	195[2]	Awaiting an order
Surface Effect Ships	RMI[b]	SES 80	54[2]	310	6	2	4.5	220[2]	Awaiting an order
	Vosper Hovermarine[a]	HM 218	32	86	6	4	1.2	113	U.S. Licensee Being Sought
	Vosper Hovermarine[a]	HM 527	33	260	9	5	4.6	288	
					Off Foils	On Foils			
Hydrofoils									
Surface Piercing	Campbell[b]	HB 78	35-38[2]	78	8	4	1.0	69[2]	Awaiting an order
	Rodriquez[a]	RHS-70	32	69	9	4	2.0	76	U.S. Licensee Being Sought
	Rodriquez[a]	RHS-200	35	300	15	7	7.0	344	
Submerged	Boeing[a]	Jetfoil 929-115	43	423	17[3]	6	16.0	745	In Production

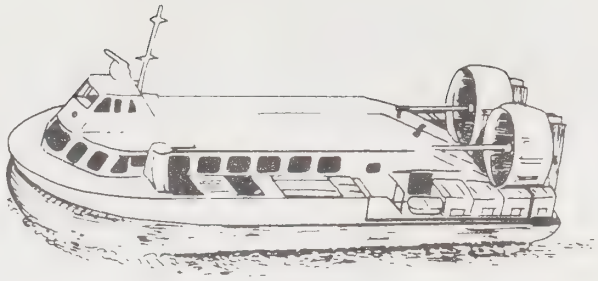
1) Fuel and Maintenance (crew costs not included)
2) Manufacturer's estimate; vessels not yet tested in revenue passenger service
3) Can be reduced to 7' when foils retracted

Source: (a) "Technical Memorandum, An Assessment of High Speed Waterborne Vessels & Their Builders", 1983, prepared for Urban Mass Transportation Administration, by: Advanced Marine Systems Assoc., Inc., in cooperation with Peat, Marwick, Mitchell and Company

(b) Manufacturers

(9502P)

Amphibious Air Cushion Vehicle (ACV)



When the ACV is in operation, it is raised or supported on a cushion of air, which is contained by a skirt encircling and extending below the entire hull. This permits the vessel to skim across the water. The ACV is fully amphibious and has no draft when it is on the cushion. When it is off-cushion it has a draft of less than one foot. Because of its ability to skim over the surface, this craft would be capable of operating in the shallowest portions of the San Francisco Bay. Propulsion is accomplished by means of rear-facing airplane-type propellers mounted on the deck of the craft. Generally, amphibious ACV's manuever by the same airplane propellers that provide propulsion since no part of the hull is in the water to facilitate steering with a rudder.

The representative sample of ACV's examined in the recent UMTA study revealed these vessels have a cruising speed ranging from 40-50 knots. The largest manufacturer of hovercraft in the free world is British Hovercraft, whose vessels are currently being used in the English Channel. The capital cost for their 94 passenger vessel is $2.5 million, and the hourly operating cost is approximately $165.00. British Hovercraft has also produced larger vessels capable of carrying 400 passengers and 60 cars at a capital cost of $35 million. While there are some U.S. manufacturers who are capable of building an ACV, as yet none have been built in this country for commercial passenger use. British Hovercraft is currently negotiating for a joint-venture with an American partner.

Due to the amphibious nature of the ACV, it does not require full water-side terminal facilities. Instead, a concrete launching ramp and a basic paved landing pad is required. The vessels have some problems with manueverability as their lack of "hard" contact with the water surface means the vessels can "slide" around much more than conventional water craft. The ACV has also been characterized by relatively high interior noise levels caused by the lift fans, and a somewhat bumpy ride. UMTA's consultants found its ability to operate in rough seas constrained because passenger comfort cannot be maintained in wave heights greater than three feet. However, in terms of the number of passenger craft presently operating worldwide, the ACV is second only to the hydrofoil. The ACV has been used for passenger service since the early 1960's.

Surface Effect Ships (SES)

The surface effect ship is constructed somewhat like a catamaran with two narrow hulls along the sidewalls of the vessel and a cavity between them.

When operating, this craft is supported on a cushion of air contained by the solid sidewalls and flexible seals at the bow and stern. It is driven with diesel powered propellers mounted in the sidewalls, and rudders provide steerage. At rest, the craft floats on the flat bottom between the two hulls, and the hulls extend below the waterline. Unlike the ACV, the SES is not an amphibious vessel and is somewhat slower; however, it manuevers better than the ACV. Cruising speed is about 32 knots for an 85 passenger version and 33 knots for a 260 passenger version (Vosper Hovermarine of Britain). The capital cost of these vessels is $1.2 million and $4.6 million, respectively, and the respective hourly operating costs are approximately $113 and $288. Conventional marine piers are adequate for docking. The draft of the SES ranges from 6 to 9 feet depending upon the size of the vessel. As in the case of ACV, there is no present U.S. manufacturer of passenger suface effect ships, but several manufacturers have the capability.

HYDROFOILS

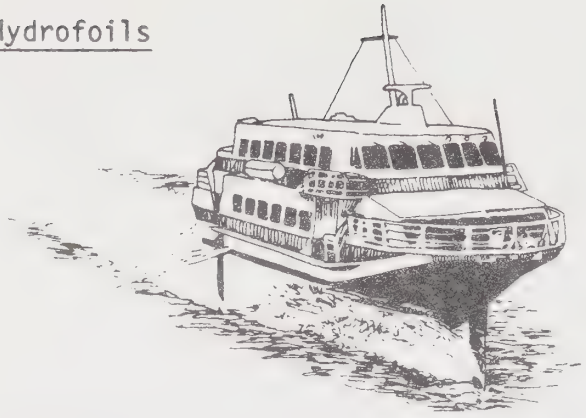
Of the three technologies, hydrofoils have been produced in the greatest number for passenger service. Hydrofoils are vessels whose hulls are lifted above the water by underwater wings connected to the hull either integrally or by surface-piercing struts. Once up on their foils, these vessels move into the high speed category. When off the foils, they operate like a conventional craft. There are two vessel types: surface piercing foil and fully submerged foil.

Surface Piercing Hydrofoils

When surface piercing foil vessels are in high speed operation, the foil "pierces" the surface, extending both above and below the water. Because the foil must react to every wave, the quality of ride in this vessel deteriorates rapidly with choppy water. It is, nevertheless, inherently stable. The cruising speeds of these vessels range from 32-35 knots.

Two Rodriquez Hydrofoils, which are representative of the industry, were examined in the previously mentioned UMTA study--the Rodriquez RHS70 and RHS200. The RHS70 has a passenger capacity of 70, costs $2 million, and cruises at 32 knots. The 200 series carries 300 passengers, costs $7 million, and cruises at 35 knots, their respective hourly operating costs are $76 and $344. A conventional ferry float is adequate for docking. When docking, hydrofoils are in the "off foil" position and therefore have a relatively deep draft. The RHS70 and RHS200 have off-foil drafts of 9 and 15 feet respectively, too deep for most Bay Area marinas. Despite drawbacks noted above, the UMTA study found these hydrofoils provide reliability and performance that as yet cannot be obtained in other technologies.

Fully Submerged Hydrofoils



Fully submerged hydrofoils are supported by lifting foils that are completely beneath the surface of the water and are attached to the hull by vertical struts. Steerage is provided by rotating the forward strut and foil. The waterjet propulsion system is powered by gas turbines. While it offers a smoother ride than the surface piercing hydrofoils, according to UMTA's research, this vessel is not inherently stable. Some form of automatic control system, similar to the automatic pilot on an airplane, must be provided to maintain the ship's attitude as it operates. The fully submerged hydrofoil is manufactured by Boeing. The Boeing Jetfoil has a cruising speed of 43 knots with a passenger load of 423. The capital cost is relatively high at $16 million, and the vessel is expensive to maintain because of the highly sophisticated computer equipment necessary to operate with a fully submerged foil. The estimated hourly operating cost is $745.

U.S. MADE VESSELS

An inventory of U.S. manufacturers was undertaken, because of the ramifications of the Merchant Marine Act of 1920 (49 U.S.C. §861 et seq.). Often referred to as the "Jones Act," this legislation requires vessels operating between points in the U.S. be constructed in this country (see Legal discussion). The United States has two established manufacturers of high speed waterborne passenger vessels:

MANUFACTURER	# VESSELS DELIVERED
Boeing Marine Systems of Seattle, Washington, manufacturer of the Jetfoil hydrofoil craft (a submerged foil vessel) since 1974; and	22 Jetfoils
Nichols Brothers of Freeland, Washington manufacturer of catamarans, under license of International Catamarans of Australia since 1983.	2 Catamarans (3 in production)

Three other U.S. manufacturers contacted by MTC staff claim they are equipped to build, but have not yet delivered high speed passenger vessels to a U.S. operator. They are:

BELL HALTER of New Orleans, Louisiana which offers, an 88 and a 400 passenger surface effect ship (SES). Coast Guard patrol boat versions of the Bell Halter SES are currently in operation as are crew boats with the U.S. Navy and Command Marine Inc. of Lafayette, Louisiana.

CAMPBELL SHIPYARDS of San Diego, California is licensed to build the hydrofoils proposed for operation on the San Francisco Bay by Forum Hydrolines. Campbell is the builder of the Golden Gate Ferry vessels. (See Chapter III)

RMI, INC. of National City, California offers an air cushion vehicle and three surface effect ships. Their ACV and one of their SES vessels are included in Table 1. RMI has had extensive involvement in the research and development of high speed SES ships under contract to the U.S. Navy. They are currently building a patrol boat version of the SES 80 for the U.S. Navy. The firm is currently negotiating for license to build both British Hovercraft and Vosper Hovermarine vessels.

The oldest and most prolific producer of high-speed waterborne craft in world today is RODRIQUEZ CANTIERE NAVAL of Messina, Italy. This firm has produced and sold over 160 hydrofoil and other high speed waterborne craft. A U.S. marine consulting firm was recently retained to help Rodriquez establish a U.S. facility for construction of their hydrofoils. They are currently negotiating with an undisclosed builder.

The appendix provides pictures and general operating characteristics of a representative sampling of the technologies described above. These exhibits have been extracted from the "Technical Memorandum, An Assessment of High Speed Waterborne Vessels and their Builders" prepared for the Urban Mass Transportation Administration by Advanced Marine Systems Associates, June, 1984.

CONCLUSIONS

1. Proven high speed waterborne transit technologies exist which offer cruising speeds of 30-43 knots (33-49 miles per hour). The U.S. manufacturer of a new ACV and SES claims cruising speeds of up to 50 and 54 knots respectively; however, these vessels have not been operated in revenue passenger service. The proven technologies include:

    catamarans (26-30 knots)
    hovercraft (32-40 knots)
    hydrofoils (32-43 knots)

    These vessels have a wide range of capital and operating costs as well as passenger capacity.

2. Currently, only the catamaran (Nichols Brothers) and hydrofoil (Boeing Jetfoil) technologies are in production in the U.S., although several U.S. manufacturers claim to have the capability of building other types of high speed vessels. Foreign manufacturers of hovercraft, both ACV and SES, and surface piercing hydrofoil vessels are looking for U.S. shipyards to build their vessels. They are in various stages of negotiation.

3. Most Bay Area marinas would require some channel dredging to accommodate these vessels, except for catamarans and amphibious hovercraft.

4. Because they have no draft, amphibious hovercraft are the only technology that could serve shallow areas of the San Francisco Bay without requiring dredging.

5. The International Catamaran design being built by Nichols Brothers is currently in operation on the Bay. This design received a favorable review in the UMTA study because it is relatively inexpensive to buy and operate. It is also reported to be quiet, comfortable, and reliable and is currently available in the U.S.

6. According to UMTA's marine consultant, the Boeing Jetfoil, also currently available in the U.S., is the quietest and most comfortable vessel available world wide. However, it is also very expensive to purchase (ten times the cost of the catamaran), operate, and maintain. Its extensive hydraulics systems require relatively labor intensive, aircraft-related maintenance practices to achieve its "truly superior performance." UMTA's consultant observed that "we have never found a commuter operation that could come close to being financially viable using the Jetfoil."

III. EXISTING AND RECENT WATER TRANSIT SERVICES

INTRODUCTION

The review of existing and recent services covers three topics: (1) Existing high speed waterborne operations worldwide; (2) Puget Sound Jetfoil Demonstrations; and (3) Bay Area waterborne passenger service. The former discusses factors influencing worldwide high speed water transit services, including vessel type, competing modes of travel, ridership characteristics, and safety. The Puget Sound section reports briefly on Jetfoil demonstrations between 1976 and 1980. The review of Bay Area services looks at both past and present high speed water transit in the Bay Area, as well as existing conventional ferry services, in order to give a better idea of this region's particular travel behavior with regard to water transit.

EXISTING HIGH SPEED WATERBORNE OPERATIONS WORLDWIDE

This section provides a review of high speed waterborne passenger service currently operating worldwide. In preparing this review, MTC staff relied upon UMTA's recently completed study of high speed waterborne transportation. One report from this study was used extensively, A Review of Selected High Speed Waterborne Operations Worldwide, August, 1984. UMTA's consultants made five site visits to 24 high speed service operators worldwide. Figure 2 depicts the location of operators contributing information to the UMTA study. UMTA reports that most of the significant high speed waterborne transportation operations in the free world were analyzed as part of the study.

The selected operators represent a complete array of available technologies, including hovercraft, catamarans, hydrofoils, and surface effect ships. For purpose of analysis, these operators have been grouped into the following five geographic categories:

- English Channel Operators
- Scandinavian Operators
- Mediterranean Operators
- Far East Operators
- South American Operators

Table 2 provides a brief description of each operator including the type of service, type of vessel, number of annual passengers, and whether or not the operator is receiving a public operating subsidy.

Following the analysis of the aforementioned operators, the UMTA report came to a number of conclusions, many of which are relevant to an analysis of service in the San Francisco Bay. These conclusions are summarized and discussed below.

Operator Characteristics

Of the 24 operators visited by UMTA's consultants, 20 are private companies. Many of the private operators are subsidiaries or divisions of larger companies which also build or repair ships or operate conventional ferry services, cargo service or public transportation services. Thus, many high speed water transit (HSWT) operators have experience in the maritime industry or public transportation.

FIGURE 2

LOCATIONS OF EXISTING WORLDWIDE HIGH SPEED WATER TRANSIT OPERATORS

Table 2

EXISTING WORLDWIDE HIGH SPEED WATER TRANSIT OPERATORS

OPERATOR	TYPE OF SERVICE	VESSEL TYPE(s)	ANNUAL PASSENGERS	PUBLIC OPERATING SUBSIDY
English Channel Operators				
o Hoverspeed LTD. - England	Daily cross channel service from England to France.	Hovercraft	1,784,000	No
o Regie Voor Maritime - Belgium	Daily cross channel service from England to Belgium	Jetfoil	250,000	N/A
Scandinavian Operators				
o Oresound - Denmark	Daily inter-city service.	Hydrofoil, Catamaran	1,500,000	No
o Stavangerske Dampskibsselskab - Norway	Daily service between coastal cities and cities and cities located on Fjords.	Catamaran	N/A	Yes
o Bergen - Nordhardland - Rutelag Norway	Daily inter-city coastal service.	Catamaran	434,000	Yes
o Flykesbaatane - Norway	One to two trips per day inter-city coastal service.	Catamaran	182,000	Yes
Mediterranean Operators				
o Ministere dei Transport e Dell' Aviazione - Italy	Daily inter-city service along Italian lakes.	Hydrofoil	587,000	Yes
o Aliscafi SNAV - Italy	Oldest HSW operator, provides daily inter-city and inter-land service.	Hydrofoil	1,883,000	Yes
o Caremar - Italy	N/A	Hydrofoil	610,000	Yes
o Societa Adriatica di Navigazione	N/A	Hydrofoil	87,000	Yes
o Ceres Hellenic Shipping Enterprises Ltd. - Greece	Daily inter-city and inter-island service.	Hydrofoil	950,000	No
o Dalex Shipping Company - Greece	Limited inter-city and inter-island service (less than once daily).	Hydrofoil	N/A	No
Far East Operators				
o Setonaika Kisen - Japan	Daily inter-city service.	Hydrofoil	471,000	No
o Sado Kisen - Japan	Daily inter-city service.	Jetfoil	407,000	N/A
o Tokushima High Speed Boat Company - Japan	Daily inter-city service.	Catamaran	281,000	N/A
o Tokai Kisen - Japan	Limited service - one scheduled trip per day.	Small Waterplane Area Twin Hull	291,000.	N/A
o Japanese National Railroad - Japan	Daily inter-city service.	Surface Effect Ship (SES)	206,000	No
o Far East Hydrofoils - Hong Kong	Daily service from Hong Kong to Macao.	Jetfoil	4,766,000	No public subsidy but operation is subsidized by revenue from Macao casinos.
o Hong Kong - Macao Hydrofoils - Hong Kong	Daily service from Hong Kong to Macao.	Hydrofoil	2,057,000	No

N/A - Data was not available

Table 2 (cont.)

EXISTING WORLDWIDE HIGH SPEED WATER TRANSIT OPERATORS

OPERATOR	TYPE OF SERVICE	VESSEL TYPE(s)	ANNUAL PASSENGERS	PUBLIC OPERATING SUBSIDY
South American Operators				
o Transtur Aerobarcus do Brazil - Brazil	Daily transbay service from Rio De Janeiro to Nitkroi and Island of Paqueta and Governor's Island in Guanabara Bay.	Hydrofoil SES	2,500,000	No
o Alimar S.A. - Argentina	Daily service from Buenos Aires to Colonia, Uruguay.	Hydrofoil	142,000	No
o Aliscatos Belt - Uruguay	Daily service from Buenos Aires to Colonia, Uruguay.	Hydrofoil	103,000	No

Source: UMTA, A Review of Selected High Speed Waterborne Operations Worldwide, August 1984.

Three Norwegian operators and four Italian operators receive government operating subsidies for one or more of their routes. The levels and methods of providing such subsidies vary greatly between countries. Fares for these subsidized operations are therefore relatively low.

Vessel Characteristics

Most operators have one type of craft built by a single builder, ranging in capacity between 100 and 195 passengers. Operators have commonly encountered major technical problems when using the first craft produced from a new design for revenue passenger service. These problems often result in substantial service disruptions. Two years of operating experience are generally required to work through these problems.

Competing Modes of Travel

While almost all of the operators compete with other modes of travel serving the same origins and destinations, virtually none of the operators compete with landside transportation offering a direct route. The competing modes of the operators by region include:

- English Channel--conventional ferries, airlines and, other operators;
- Scandinavia--conventional ferries, airlines, and auto or bus on land routes that are circuitous and time consuming.
- Mediterranean--conventional ferries, other HSWT operators and airlines;
- Far East--conventional ferries, airlines, and other HSWT operators;
- South America--conventional ferries, airlines, autos, and buses.

None of the operators discussed in UMTA's report provide primary work-related commute service, and none competes with an extensive highway and landside transit system, as would be the case for all service proposed on San Francisco Bay.

High speed water transit services usually require less travel time but higher fares than competing travel alternatives, except possibly airline services. Fares on HSWT services are often significantly higher than on conventional ferries operating on the same route.

Ridership Characteristics

Most of the operators surveyed indicated that ridership varies by season, with peak demand in the summer. On some HSWT operations, over 50 percent of the patrons travel in the summer months, thus indicating a strong market for recreational travel. HSWT operators service two predominant travel markets--recreational and business trips. There appears to be no example of a HSWT service that is being primarily used for intra-city commute purposes.

In 1982, of the HSWT services analyzed by UMTA, Far East Hydrofoil carried the greatest number of passengers--4.8 million. Far East Hydrofoil along with Hong Kong Macao Hydrofoil serve Hong Kong and the casinos at Macao. Of the operators providing data on annual passengers served, 35 percent of all HSWT patrons worldwide travel from Hong Kong to Macao.

Operating and Safety Characteristics

HSWT services operate safely and efficiently in busy harbors and sea lanes. The vast majority of HSWT operators have not experienced personal injury or fatal accidents, and several of these operations have provided service for many years.

Various factors restrict the speed of the craft. Wave heights and wind conditions are the most common restrictions. Other restrictions include in-harbor speed limits, waterborne traffic, ice, and fog.

PUGET SOUND JETFOIL DEMONSTRATIONS

Between 1976 and 1980 the Boeing Jetfoil was used in three demonstrations in the Puget Sound area of the Pacific Northwest. Service ranged from one to three daily round trips from Seattle to Victoria, British Columbia, and other points along Puget Sound. The Washington State Department of Transportation's analysis of this service showed that a two-Jetfoil operation combining cross-sound and north-south routes would be economically feasible. An American-Canadian group has announced plans to institute service between Seattle, Victoria, and Vancouver in spring, 1985.

BAY AREA WATERBORNE PASSENGER SERVICE

There are several on-going and recent Bay Area ferry operations that are relevant to this analysis. These include the Golden Gate Bridge District's Larkspur and Sausalito Ferries, the Tiburon Ferry Service, the recent Berkeley Ferry Services, and the Oakland Airport Air Cushion Vehicle Demonstration Project. Each of these services is examined in this section.

Golden Gate Bridge District Larkspur Ferry

The Larkspur Ferry has been operated by the Ferry Transit Division of the Golden Gate Bridge, Highway, and Transportation District since December 1976. Two vessels currently operate over an 11-nautical mile route from Larkspur to the downtown San Francisco Ferry Building. These vessels are semi-planing hulls, which enable them to rise partly out of the water when cruising. They operate at a cruising speed of 21 knots and have a passenger capacity of 750. The ferries originally contained gas turbine engines, but due to the high cost of maintenance and fuel, the engines are being converted to diesel.

Table 3 contains information on the level of service, patronage, fare, and operating costs of the Larkspur Ferry since 1980. An analysis of these data shows that the strongest correlation is between the number of daily round trips and the patronage. In 1981, the number of round trips per day was cut from nine to three in order to reduce overall operating costs, and patronage began to fall. Recently, in anticipation of the conversion to diesel engines and the lower associated operating costs, the number of round trips per day has increased from 3 to 8. As the figures for the month of October show, patronage has risen with this increase in service. In fall, 1985, when all three vessels have been converted to diesel engines, a minimum of two additional commute hour trips will be added. If patronage on the off peak continues to rise, there may be sufficient vessel capacity to double the current service level.

Table 3

LARKSPUR and SAUSALITO FERRY STATISTICS

YEAR	1980	1981	1982	1983	1984
			LARKSPUR		
Yearly Patronage - peak period	473,000	425,000	386,000	335,000	316,000
Patronage - Month of October	47,000	31,000	29,000	25,350	32,360
Travel Times (one way in minutes)	42,44*	44,48,46*	46	46	46
Daily Round Trips	10,9*	9, 3* (6/81)	3	3	3, 8* (6/84)
Fare					
Commute Book	$1.35, 1.20*, 1.00*	$1.00, 1.80*, 1.58*	$1.58, 1.80*	$1.80	$1.80, 1.98*
Adult Cash	$1.50	$2.00	$2.00	$2.00, 2.10*	$2.10, 2.20*
Operating Costs (in millions)					
Labor	$2.2	$1.6	$1.8	$1.9	$1.9
Other	3.2	2.1	1.1	2.0	2.2
Total	5.4	3.7	2.9	3.9	4.1
			SAUSALITO		
Yearly Patronage	854,000	829,000	717,000	553,000	573,000
Fare					
Commute Book	$1.13	$1.13, $1.31* (March)	$1.31, $1.49* (July)	$1.49, $1.58* (July)	$1.58, $1.67* (July)
Adult Cash	$2.00	$2.00	$2.00, $2.50* (July)	$2.50	$2.50, $2.75* (July)
Operating Costs (in millions)					
Labor	$1.1	$1.2	$1.3	$1.5	$1.0
Other	1.7	1.1	2.2	1.0	1.2
Total	2.8	2.3	3.5	2.5	2.2

*Reflects the fare or speed changes over the course of the year

Note: Travel times and number of daily round trips for Sausalito have remained constant: 30-minute travel time; 18 daily crossings; 12 weekend crossings

Golden Gate Bridge District Sausalito Ferry

The Sausalito Ferry has been operated by the Ferry Transit Division of Golden Gate since 1970. Unlike Larkspur, its market is primarily tourists. One vessel operates over a 5 and one half nautical mile route from Sausalito to the San Francisco Ferry Building. It is a diesel powered conventional hull vessel with a passenger capacity of 575. Cruising speed is 14.5 knots and the one-way travel time is 30 minutes. The fare is $2.75 on weekdays and $3.00 on weekends. Back-up service is provided by the Golden Gate bus system. There are 18 daily ferry trips on this route, five of which serve commuters. Thus, the majority of riders represent recreational travelers. Unlike Larkspur, the number of trips and travel times have not fluctuated over the years. Ridership fluctuates considerably by season with highest patronage in the summer months. Table 3 contains information on yearly patronage and fares. Since August, 1982, when Red and White began service from Sausalito to the Fisherman's Wharf area, Golden Gate's share of the total market has gradually decreased. Overall, roughly 50 percent of Golden Gate's operating costs are recovered by fares.

Tiburon Ferry

Harbor Carriers, Inc., also known as Red & White, has been operating ferry service from Tiburon to downtown San Francisco for 21 years. Prior to October of this year, two conventional vessels had been used. Since that time Red & White began operating a high speed catamaran built by Nichols Brothers of Washington, capable of achieving 26 knots. According to David Pence, General Manager of Red & White, for the first time in 21 years, the Tiburon service is expected to turn a profit. This turnaround is due to the 13 percent to 16 percent increase in patronage that has been observed since the implementation of the catamaran, as well as the catamaran's lower operating costs. Because the catamaran can make the run in 16.5 minutes instead of 35 minutes, the same service can be provided using only one vessel rather than two. In addition, the catamaran requires three crew members, rather than the nine required by the two conventional vessels.

Berkeley Ferry Services

Both Blue & Gold Lines, Inc., and Red & White have operated ferry service from Berkeley to downtown San Francisco. Red and White operated service for three to four months in 1979 during the period of time that BART was shut down due to a fire in the tube. They ran two round trips per day when BART was out of service, and one round trip per day after BART resumed service. The adult fare was $1.25, comparable to BART. The service was subsidized from bridge toll revenues. Service was terminated because there was considerably less patronage than projected; fare revenues were only able to return about 12 percent of the total operating costs.

Blue & Gold Lines operated one daily round trip from Berkeley to San Francisco for nine months during 1981. According to Roger Murphy, President of Blue & Gold, service was terminated because of insufficient patronage. The fare was $1.25, again comparable to BART, and the service did not receive a public subsidy.

Port of Oakland Air Cushion Vehicle Demonstration

From August 1965 to August 1966, two 14 passenger SK-5 air cushion vehicles (ACV) were demonstrated in public transportation service between the Oakland Airport, San Francisco Airport, and Pier 50B in San Francisco, approximately one mile south of the Bay Bridge. This demonstration was sponsored and administered by the Port of Oakland and was financed by a grant from the Department of Housing and Urban Development (HUD). Assisting in the demonstration were Bell Aerosystems Company, which supplied the two air cushion vehicles, crew training, and technical support; SFO Helicopter Airlines Inc., which operated the service; and the University of California, Berkeley, which provided research and analytical support in evaluating the demonstration. The purpose of the project was to determine the operational and economic feasibility and public acceptance of using air cushion vehicles to provide airport access and public transportation in metropolitan areas. The following summarizes the findings of this demonstration project.

Terminals

The terminals at the two airports were the same facilities used by the operator, SFO Helicopter Airlines, Inc., for the loading and unloading of helicopter passengers. Suitable ramps were prepared to provide access to the water. In San Francisco, a terminal consisting of wooden ramps 50 feet wide and 100 feet long was constructed at Pier 50B. An adjacent building was renovated as a ticketing and passenger waiting area. The San Francisco terminal was not placed in operation until November 1, 1965, while the two airport terminals were fully operational when the demonstration service began on August 10, 1965.

Reliability of Service

During the year's demonstration the two ACVs completed a total of 3,272 of the 4,481 trips scheduled, producing a reliability of 73 percent. Of the uncompleted trips, 8.6 percent were due to mechanical problems, 13.7 percent were due to weather, 4.7 percent were due to other conditions. The service carried 12,510 passengers, with an overall load factor of 27.3 percent.

Route Volumes

Of the two routes, Oakland Airport to the San Francisco Airport was the most heavily traveled and was dominantly directional from Oakland to San Francisco. Fewer passengers were carried in the Oakland to downtown San Francisco route than were anticipated. It was felt that a terminal closer to the central business district would have increased patronage on this route.

Conclusions from ACV Demonstration

The final report concluded that the technical feasibility of providing passenger service over the selected routes was operationally proven. However, the SK-5, was not ideally suited for this service because of its small passenger capacity and the resulting high operating costs. The service was discontinued on August 10, 1966, when the terms of the original demonstration grant expired.

CONCLUSIONS

The following conclusions are based on the UMTA report and MTC's staff research of Bay Area services.

- Existing high speed water transit service has two predominant travel markets--recreational and business trips.
- None of the operators discussed in UMTA's report provide primary work-related commute service and none competes with an extensive highway and landside transit system, as in the Bay Area.
- High speed water transit service has been shown to be safe and reliable.
- Frequency of service appears to be the most significant factor in attracting and keeping patrons.
- High speed vessels can provide operating efficiencies by decreasing turnaround time.
- Operators have commonly encountered major technical problems when using the first craft produced from a new design for revenue passenger service. When using new technology, two years are generally required to resolve operating problems, and to establish patronage levels.
- Of the 24 operators studied by UMTA, 20 are private companies. Many small operators are subsidiaries of larger companies and have experience in the maritime industry or public transportation.

IV. WATER TRANSIT PROPOSALS

INTRODUCTION

At the July meeting of the Metropolitan Transportation Commission, proposals were presented for high speed water transit on the Bay. Following approval of the study scope of work by the Work Program and Plan Revision Committee in August, each person who presented a proposal at the Commission meeting was sent a detailed questionnaire requesting all pertinent information about that proposal. MTC staff followed this up with a personal interview(s) and telephone conversations with each proposer. This section summarizes and documents the five proposals that have emerged during the course of this study.

- Harbor Bay Isle Associates (HBI) - service between the City of Alameda and San Francisco.
- Forum Hydrolines, Dr. Nichols Hetzer - four routes: from San Rafael to San Francisco, Alameda to San Francisco, San Francisco Airport to Oakland Airport and Pittsburg to San Francisco.
- Marin County Supervisor Robert Roumiguiere - service from Marin County to San Francisco.
- Pacific Transportation Systems - service from San Jose to to San Francisco Airport, downtown San Francisco, and Oakland Airport.
- Pittsburg Chamber of Commerce - service from Pittsburg to Martinez to San Francisco.

These proposals are varied in their level of detail, depending upon how far each proposal has progressed toward actual implementation, and the amount of data made available to MTC staff. In some cases the proposals are still at a conceptual stage. Each of the five proposals is described below. An analysis of each proposal is contained in Chapter V.

FORUM HYDROLINES

Forum Hydrolines has preliminarily proposed to operate hydrofoil service on four routes in the Bay, utilizing a fleet of surface-piercing hydrofoils ranging in capacity from 60 to 81 passengers. The capital cost of these vessels range from $800,000 to $950,000 and they can reach a cruising speed of 35 knots. Campbell Shipyards of San Diego is licensed to build the hydrofoils proposed for operation by Forum, but as yet has not put the vessel in production.

Forum Hydrolines does not intend to seek public subsidy in providing this service, rather they are working with a group of private investors. Although Forum Hydrolines has no previous experience as an operator, members of their staff do have operating expertise. Forum is not presently licensed to operate by the PUC. They intend to commence service 4 to 6 months after securing funding.

Route #1 - San Rafael to San Francisco

Forum Hydrolines proposes to run service from the San Francisco Ferry Building to the Larkspur Ferry Terminal or the Loch Lomand Marina in San Rafael. As yet arrangements have not been concluded by Forum to acquire docking facilities. In the case of the Larkspur Ferry Terminal, the configuration of the terminal is geared to second deck loading. Because the hydrofoils to be

used by Forum are single deck vessels, it may not be possible to use the Larkspur facility. It is also unclear whether the Golden Gate Bridge District would allow a competing ferry service to use their terminal. Golden Gate Bridge, Highway and Transportation District has in the past opposed such competing service when applications have been filed with the California Public Utilities Commission.

Route #2 - City of Alameda, Harbor Bay Isle to San Francisco

Forum has proposed service from Harbor Bay Isle to San Francisco. As was described earlier, Harbor Bay Isle Associates is planning to run their own water transit service from the Harbor Bay Isle Business Park. At this point, it is Harbor Bay Isle's intent to provide all transportation necessary to serve the business park.*

Route #3 - San Francisco Airport to Oakland Airport

Forum proposes to run service between the hours of 6:00 a.m. and 8:00 p.m. at one hour headways. Terminal facilities at the two airports have not yet been acquired.

Route #4 - Pittsburg to San Francisco

Forum Hydrolines has proposed to run commute service from Pittsburg to San Francisco. Under the terms of this proposal, the City of Pittsburg would buy the vessels and lease them back to Forum, the City would also provide a terminal and patron parking facilities.

* Prior to the issuance of the final report, Forum advised MTC staff that they no longer intend to serve Harbor Bay Isle, but intend to service the City of Alameda from another point.

Exhibit 1

Proposer - Forum Hydrolines

Contact Person - Dr. Nicholas Hetzer
310 Oakview Rd.
Pleasant Hill, CA. 94523
(415) 540-8400

Operator - Forum Hydrolines operating under the name of Forhop

Routes

1	San Rafael to San Francisco.
2	Alameda to San Francisco. *
3	San Francisco Airport to Oakland Airport.
4	Pittsburg to San Francisco

Schedule - Forum Hydrolines proposes operating commute service on routes from San Rafael and Alameda to San Francisco during the hours of approximately 6:00 a.m. to 11:00 a.m. and 3:00 p.m. to 7:30 p.m. During the remainder of the day and weekends they intend to operate shopper's specials and tourist runs.

They plan to run service from San Francisco Airport to Oakland Airport at one hour headways from 6:00 a.m. to 9:00 a.m.

The proposed schedule for the Pittsburg to San Francisco service is half hour headways during the hours of 5:00 a.m. to 9:00 a.m. and 2:30 p.m. to 6:30 p.m.

Travel Times/Fares

Route	Estimated One Way Travel Time	Proposed Fares
San Rafael to San Francisco		
commuter	19 min.	$2.75
tourist		6.00
shopper		6.00
Alameda to San Francisco		
commuter	14 min.	2.25
tourist		6.00
shopper		6.00
San Francisco Airport to Oakland Airport	16 min.	8.00
Pittsburg to San Francisco	70 min.	4.00

Vessel - Surface-piercing Hydrofoil. Passenger capacity ranges from 60 to 81 passengers; the cruising speed is 35 knots; the draft is 8 feet.

Scheduled Service Start Up - 4 to 6 months after obtaining funding.

Funding Source - Private Investors.

* Prior to issuance of the final report, Forum advised MTC staff that they no longer intend to serve Harbor Bay Isle, but will serve the City of Alameda from another point.

HARBOR BAY ISLE ASSOCIATES

Harbor Bay Isle Associates (HBI) of Alameda began a twelve month trial of the Vosper Hovermarine Surface Effect Ship (SES), Model 218, in October, 1984. The purpose of this trial is to see how well the vessel operates in Bay waters, to determine its economic viability and environmental effects, and to acertain its level of public acceptance. During the demonstration period, HBI will be inviting governmental, civic and business leaders from around the Bay Area to ride their vessel. Temporary arrangements have been made with the Port of San Francisco for HBI to dock the vessel at the San Francisco Ferry Building. Although the SES Model 218 is capable of carrying 85 passengers, it has been equipped with a more comfortable 45 passenger seating arrangement for the demonstration period.

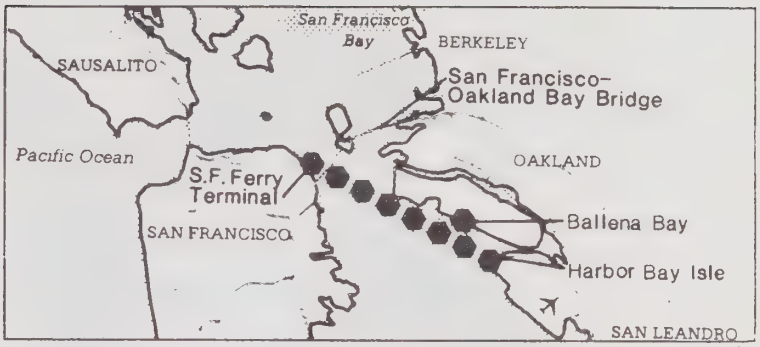
HBI's long-range proposal is to operate high speed water transit service from HBI Business Park and Ballena Bay in the City of Alameda to the San Francisco Ferry Building. Their proposal includes construction of terminal facilities at both the HBI Business Park and Ballena Bay. Permanent docking facilities will be arranged at the Ferry Building based on the results of the trial. HBI plans to design and own or lease their vessels, and to operate the service themselves. Stanley M. Kowleski, former manager of the Golden Gate Ferry System, has been hired by HBI to manage the service. Although they are testing the SES, they are not yet committed to using any particular type of vessel. The proposed service would be offered at 30-minute headways during peak commute periods as part of an overall transportation program being designed for the HBI Business Park. This transportation progam includes a shuttle bus system that would transport passengers from the Business Park to the Harbor Bay Terminal. HBI would like to begin regular service by Fall of 1986. Should service be extended to the general public, HBI may look to a public transit entity for financial assistance.

Exhibit 2

Proposer - Harbor Bay Isle Associates

Contact Person - Stanley M. Koweleski
Vice President Transportation Services
Harbor Bay Isle
936 Shorepoint Court
Alameda, CA. 94501
(415) 521-1771

Operator - Harbor Bay Isle Associates



Route(s)

- Harbor Bay Business Park in Alameda to San Francisco Ferry Building.
- Ballena Bay in Alameda to San Francisco Ferry Building.

Schedule - 30-minute headways during peak commute period.

Travel Times/Fares

Fares have not yet been determined.

One Way Travel Time: approximately 15 to 20 minutes, but will depend on vessel type selected.

Vessel - A decision on the exact technology has not been made. The operator is presently considering a Surface Effect Ship, model 218, by Vosper Hovermarine. A 12 month trial of this vessel commenced in October, 1984. This vessel is designed to hold 85 passengers; it has a cruising speed of 32 knots, and a 5 foot draft.

Scheduled Service Start Up - Fall, 1986

Funding Source - Harbor Bay Isle Associates; however, HBI may look to a public transit entity for financial assistance should service be extended to the general public.

MARIN COUNTY SUPERVISOR ROBERT ROUMIGUIERE

Supervisor Roumiguiere's proposal is conceptual at this time. His interest, as well as that of the Marin County Board of Supervisors, stems from the traffic congestion on Route 101. The Marin Route 101 Task Force has been addressing this issue and will soon release its report. One of the report's recommendations is expected to be that by the year 2005 10 percent of the transbay commute traffic (about 4,900 people) be diverted to high speed water transit.

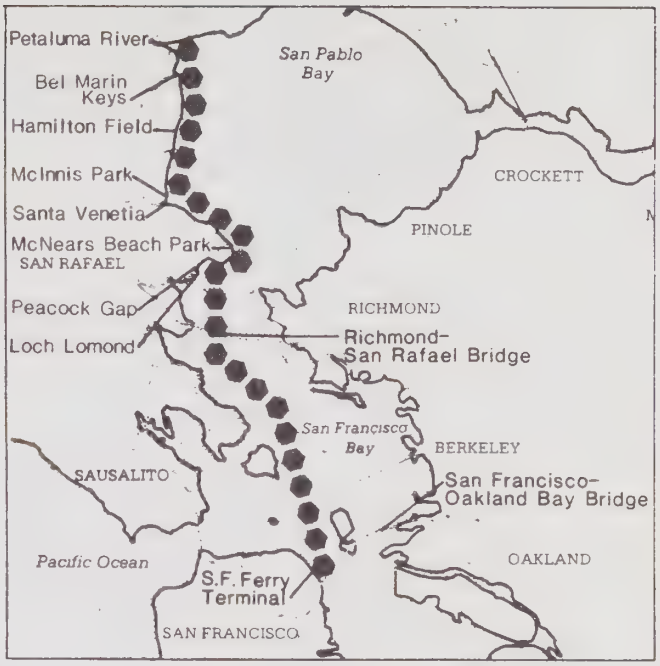
The technology originally proposed was hovercraft because of the shallow areas around San Pablo Bay and the minimal decking facilities required. A ramp with a 10 percent slope is adequate for hovercraft to land. However, an initial analysis performed as part of this study indicates that a catamaran may be more cost effective even with the inclusion of dredging costs required to accommodate the catamaran's draft. As a result of these findings, Supervisor Roumiguiere is currently proposing that both types of vessels be investigated for possible implementation. Supervisor Roumiguiere has been in contact with a Southern California firm, RMI, which is currently negotiating for license to construct the British Hovercraft vessel, AP 1-88 which is capable of a 40 knot cruising speed and carries 94 passengers.

The preferred public operator for North Bay high speed water transit is the Golden Gate Ferry Division. As an established public operator, it would be eligible for federal capital grants for purchase of vessels.

Proposer - Supervisor Robert Roumiguiere

Contact Person - Supervisor Robert Roumiguiere
315 Civic Drive
San Rafael, CA. 94903
(415) 499-7331

Operator- Unknown; proposer's suggestions are Golden Gate Ferry System, a private operator, or a new regional operator



Routes

Eight potential sites along the Marin shoreline to the San Francisco Ferry Building have been identified. A market feasibility study is proposed to determine which sites are feasible:

- Petaluma River to San Francisco
- Bel Marin Keys to San Francisco
- Hamilton Field to San Francisco
- McGinnis Park to San Francisco
- Santa Venetia to San Francisco
- McNears to San Francisco
- Peacock Gap to San Francisco
- Loch Lomond to San Francisco

It is assumed that Golden Gate will continue to serve Larkspur and Sausalito to the south.

Schedule - commute service would be run during peak periods, headways would be developed through the feasibility study.

Travel Times/Fares

No information available.

Vessel

AP 1-88 hovercraft (British Hovercraft design) with passenger capacity of 94 and 40 knot cruising speed, or a 400-passenger catamaran capable of cruising at 30 knots.

Scheduled Service Start Up - no date set.

Funding Source - unknown; would depend on operating entity.

PACIFIC TRANSPORTATION SYSTEMS

Pacific Transportation Systems is proposing to operate hovercraft service from San Jose to the San Francisco and Oakland Airports and downtown San Francisco. Although they have not decided on the exact model of hovercraft, they are looking into the AP 1-88, 94-passenger hovercraft. Their proposal is to provide revenue passenger service every two hours from 6:00 a.m. to midnight daily. The proposed service will be financed completely by private funding sources. According to the proposers, they have already obtained the support of a number of private investors. Because they do not want to make public any estimates of capital or operating expenses for the service, MTC staff was not supplied with cost information.

Because of the issue of water access to San Jose, the South Bay point of debarkation will actually be in Alviso. Terminal facilities have not yet been secured by Pacific Transportation Systems, but they report they are in the process of preliminary negotiations with the two Airports and the Alviso property owner. In order to connect passengers coming from San Jose to Alviso, they are also proposing to build a people mover.

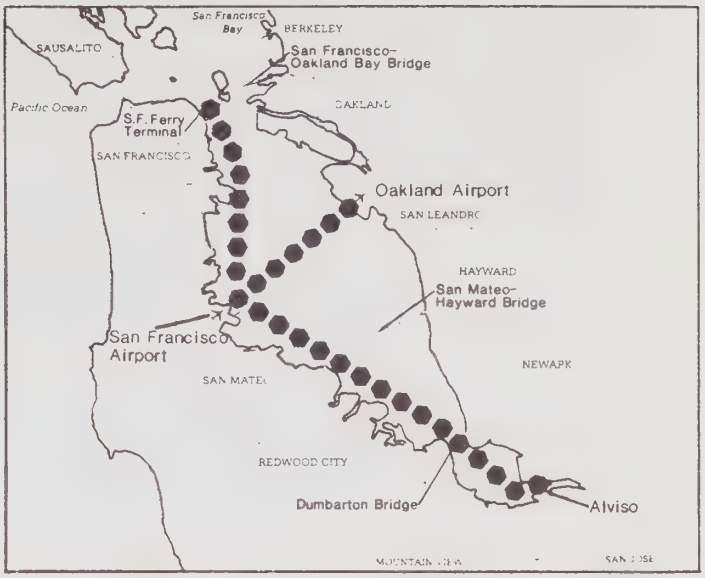
Pacific Transportation Systems is planning to act as the water transit operator. In implementing the service they plan to hire personnel experienced in water transit operations. They are not yet licensed to operate by the PUC and have no previous experience in operating a ferry service. Pacific Transportation Systems hopes to be able to begin service in approximately two years.

Proposer - Pacific Transportation Systems

Contact Person - John Ellis
Pacific Transportation Systems
P.O. Box 2845
Santa Clara, CA. 94055
(408) 554-7586

Operator - Pacific Transportation Systems

Routes- San Jose (Alviso) to Oakland Airport to San Francisco Airport.



Schedule - Daily service every two hours from 6:00 a.m. to midnight.

Travel Times/Fare - Information on fares was not available. Proposed one way travel times are as follows:
Alviso to downtown San Francisco - 45 minutes; Oakland Airport to San Francisco Airport - 15 minutes; San Francisco Airport to Alviso - 30 minutes.

Vessel - 100 Passenger Hovercraft, the exact design and manufacturer has not been decided.

Scheduled Service Start Up - Approximately two years, given lead time necessary to negotiate licensing agreements and set up U.S. manufacturing.

Funding Source - Private Investors.

PITTSBURG CHAMBER OF COMMERCE

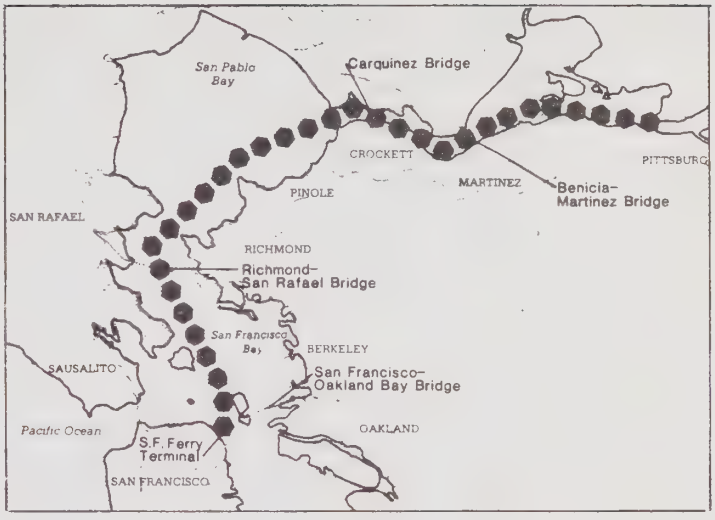
The Pittsburg Chamber of Commerce is proposing that commute-hour water transit service from Pittsburg and Martinez to downtown San Francisco be implemented using a 400 passenger Nichols Brothers Catamaran, purchased and operated by Blue and Gold Lines, Inc. Blue and Gold is an experienced, licensed operator currently offering tourist service on the Bay, but has not made a firm commitment to operate this service. The proposal calls for service to start April, 1985 with one daily round trip. The one-way fare would be $4.00. In order for operating costs to be covered, based on a fifty percent occupancy rate, a $4.00 per passenger trip subsidy would also be required.

The Nichols Brothers Catamaran is capable of traveling at a speed of approximately 30 knots fully loaded and could therefore complete the one way trip in approximately an hour and a half. The capital cost of this vessel is approximately $1.8 million. Blue and Gold Lines, Inc. has ordered this model catamaran and expects delivery by Spring of 1985. At the present time they are planning to use this vessel for tourist travel such as ocean-going whale watch tours. While they do not now plan to offer commute service to Pittsburg, if a favorable marketing analysis were to be completed, they would consider operating such a service.

The proposal states that if Blue and Gold Lines were to agree to operate this service, terminal space already available to Blue and Gold at the San Francisco Ferry Building can be used. Although terminal facilities in Pittsburg and Martinez have not yet been established, both cities are currently investigating possible docking sites.

Proposer - City of Pittsburg Chamber of Commerce

Contact Person - Robert E. Jones
Executive Vice President
Pittsburg Chamber of Commerce
2010 Railroad Avenue
Pittsburg, CA. 94565
(415) 432-7301



Operator - Blue and Gold Lines, Inc.

Routes - Pittsburg to Martinez to San Francisco.

Schedule - One daily commuter run during a.m. and p.m. peak.

Travel Times/Fare - The one-way travel time is approximately one hour and 30 minutes: the proposed one-way fare is $4.00.

Vessel - Nichols Brothers 400 passenger, 85 foot Catamaran, 30 knot cruising speed, 5 foot draft.

Scheduled Start Up - Spring, 1985.

Funding Source - The catamaran being proposed for service is being purchased by Blue and Gold Lines, Inc. However, a $4.00 per passenger trip subsidy will be required to cover operating costs. The funding for this subsidy has not yet been secured.

CONCLUSIONS

1. These five proposals are in various stages of readiness, with HBI having begun testing a vessel in October, 1984.

2. A complete range of high speed vessel technologies have been proposed including catamaran, hydrofoil, surface effect ships, and hovercraft. The cruising speed of these vessels range from approximately 30 to 40 knots.

3. These proposals will require varying degrees of terminal agreements and/or construction and may involve some channel dredging.

4. Of the five proposals, two are proposing some form of public subsidy -- the Pittsburg Chamber of Commerce's proposal for service from Pittsburg to San Francisco, and Supervisor Roumiguiere's proposal for service from Marin to San Francisco. HBI may be looking for public subsidy at some point in the future, but at this point they are still in the process of formulating their plan.

V. LEGAL AND INSTITUTIONAL CONSIDERATIONS

INTRODUCTION

The first part of this discussion focuses on state and federal statutes which constitute a constraint to the implementation of high speed marine transit. The second part gives an overview of institutional considerations, and focuses on identification of those agencies that issue licenses and permits to water transit operators, or have jurisdiction over the Bay. The overview of institutional considerations is not intended to provide an exhaustive list of all permits and licenses an operator will need. Rather, it gives an indication of the types of permits needed and provides potential operators with enough information to begin the permit process.

LEGAL

The examination of legal issues consisted of a review of federal and state statutes by the study staff and MTC's legal counsel. Counsel has concluded that establishing new ferry service is constrained by the California Streets and Highways Code which precludes operation of ferry service in competition with a toll bridge whose revenues are pledged to bond repayment, and restrictive covenants in the bonds themselves. Because our review does not represent an analysis of all possible legal issues relating to the proposals, individual proposers should seek further counsel, as necessary.

State Legislation

The Streets and Highways (S&H) Code Sections 30350 through 30352 constitute the most important legal issue to be addressed. These sections of the code preclude establishment of ferry service on the San Francisco Bay within a distance of ten miles of either side of a toll bridge when there are outstanding bridge revenue bonds, unless the ferry was an existing operating franchise prior to authorization of the revenue bonds. The intent of these sections is to prohibit a new ferry franchise from operating across the Bay along the same corridor that is served by the bridge. Such service would be considered to be in competition with the bridge.

Exceptions to this restriction are:

1. These sections do not preclude an operator from serving two points along the same side of the Bay. For example, an operator could run service from San Francisco to the San Francisco Airport, or from Oakland to the Oakland Airport.

2. Sections 30354 and 30355 authorize Golden Gate Bridge, Highway and Transportation District (GGBHTD) to operate ferries along the Marin County-San Francisco corridor, regardless of outstanding bonds on bay bridges.

3. Section 30358 authorizes the City of Emeryville to operate service to San Francisco, subject to MTC's approval as well as approval from bridge bond holders.

4. Service between the City and County of San Francisco and the City of Alameda, provided such service is authorized or permitted by the California Transportation Commission, after first being approved by MTC (Section 30356). Such service can be publicly or privately operated. While the two proposals for service from Alameda to the San Francisco Ferry Building made by Harbor Bay Isle and Forum Hydrolines fall within this provision, section 6.10 of the current bond on the San Francisco Bay Bridge restricts the establishment of any ferry service unless franchised by the CTC and then only when revenues are pledged to payment of the debt service for the revenue bonds financing construction of the new Dumbarton Bridge. This issue is discussed in more detail under Toll Revenue Bonds.

5. Ferry service across the Bay in the general vicinity of the San Francisco-Oakland Bay Bridge, if such service is established by CTC and operated and maintained by CTC or Caltrans, after first being subject to the approval of MTC (Section 30356). Such service is limited only to a CTC/Caltrans operation, and again the revenues must be pledged to repayment of the bonds.

6. Ferry service authorized or permitted by the CTC during any period when any of the toll bridges are obstructed because of accident or repair, or are "for any reason unable to fully accommodate traffic" (Section 30356). Ferry service under such conditions do not require MTC approval. This section has never been subject to application. Therefore, it could be argued that regular delays in morning and evening commute hours is a condition under which the bridge is unable to fully accommodate traffic, hence ferry service could be permitted during these periods.

Toll Revenue Bonds

The toll revenue bonds which financed the Dumbarton Bridge construction were sold by the California Transportation Commission in 1981. One important provision of the bond indenture under which these bonds were issued is section 6.10 entitled "Competitive Facilities" and reads as follows:

> "The Commission will, so far as lies in its power, permit the construction or maintenance or any means of crossing the San Francisco Bay within a distance of ten miles from either side of any of the Bridges only if the revenues from such facility are pledged to the payment of the bonds in the same manner in which the Revenues from the Bridges are pledged."

Bridges with toll revenues pledged to Dumbarton Bridge bonds include the San Mateo - Hayward, San Francisco - Oakland, and Dumbarton Bridges.

It is likely any effort by a potential ferry boat operator to traverse between East and West Bay will result in legal action from Caltrans, the California Transportation Commission (CTC), and/or individual bond holders. Caltrans' counsel has stated in a March 26, 1984 letter regarding Harbor Bay Isle's proposed service between Alameda and San Francisco, that Caltrans would be obligated to take some action under its bond indenture to protect bond holders if HBI were to institute ferry service.

There are also outstanding bonds on the Antioch and Carquinez Strait Bridges. Section 7.09 of the Revenue Bonds for those bridges directs the State (Toll Bridge Authority) to prevent the operation of a passenger ferry across either the Sacramento or San Joaquin Rivers while bonds are outstanding.

Because of restrictive language in the Streets & Highways Code, as well as the Dumbarton Bridge and Antioch and Carquinez Straight bond indentures, virtually any new ferry service, which proposes transbay operations would be prohibited. Only shoreline service would be permissable.

Federal Legislation

There are two pieces of federal legislation which could affect implementation of water transit on the Bay. The first, the Merchant Marine Act of 1920, commonly referred to as the "Jones Act," prohibits the transport of passengers by a foreign built vessel between points in the U.S., subject to a penalty of $200 for each passenger. In addition to requiring that a vessel be American-built and documented in the United States, the Coast Guard regulations also require that the vessel be owned by U.S. citizens. It is generally acknowledged that the Jones Act is unlikely to be amended to enable foreign built vessels to operate in passenger service in U.S. waters. As was discussed in the Technology Review, foreign manufacturers are seeking U.S. licensees to manufacture their boats.

The second piece of legislation is the UMTA Act [49 U.S.C. § 1601 et seq.] which contains a provision [49 U.S.C. § 1602(e)] that relates to competition with existing operators. Should a new public operator who is in competition with an existing operator, either public or private, seek federal funding, UMTA must make certain findings before it may approve the grant. For example, adequate compensation must be paid to companies whose franchises or property are acquired. Additionally, the Secretary of Labor must certify that any federal assistance complies with requirements of 49 U.S.C. § 1609(c) [concerning protection of workers' jobs and benefits].

INSTITUTIONAL

Although the focus has been to identify legal constraints to implementation of new water transit service, staff also examined related institutional issues relative to speed limits in the Bay, and docking facilities. Our investigations have brought us in contact with several agencies that have jurisdiction over the Bay. These agencies are responsible for issuing licenses and permits for development of terminal and docking facilities, and for other uses of the Bay. An overview of their jurisdictions is briefly summarized following the discussion of speed limits and docking facilities.

Speed Limits

One concern has been whether a speed limit is imposed on the open waters of the Bay. The only speed limit imposed on inland waters is in marinas and where swimmers are present. A five mile per hour speed limit is enforced in these areas. In other places, speed limitation may also be necessary to prevent wake damage. Generally, once a vessel is in open waters, speed would only be limited by weather conditions and good seamanlike practices.

Docking Facilities

Another issue encountered relates to docking facilities. It is unclear, for example, whether a new operator would be able to share the Golden Gate Bridge District's docking facilities at the San Francisco Fery Building. Golden Gate's equipment is highly specialized to suit its vessels. This equipment may not be compatible with other craft. There may also be space limitations and time constraints should other operators wish to use these facilities in peak commute periods.

Docking may also be a problem in the vicinity of Harbor Bay Isle Business Park in Alameda. This shoreline property is owned by Harboy Bay Isle Associates, which intends to provide water transit for its Business Park and other parts of Alameda. Harbor Bay plans to construct its own Alameda terminals, and may not permit a competing service to use its docking facilities.

Licenses, Permits and Authorizations Required for Water Transit Services

In addition to the statutes discussed in the first part of this section, any new operator of ferries would have to make its way through the rules and regulations of several federal, state, regional, and local agencies. Our initial research for this project brought MTC in contact with several of these agencies. Table 4 contains an overview of these agencies and their areas of jurisdiction. The administrative steps required to complete the process should be reviewed by the appropriate legal staffs of potential operators.

TABLE 4

LICENSES, PERMITS AND AUTHORIZATIONS REQUIRED FOR WATER TRANSIT SERVICES - SAN FRANCISCO BAY

AGENCY	JURISDICTION
City or County	Building permits to construct terminals; Business licenses for ferry services
Bay Conservation and Development Commission (BCDC)	Permits to use terminal for passenger service that previously was used solely for recreational purposes; Permits for routine maintenance, dredging, and construction of small docks; Permits for major construction and dredging
Metropolitan Transportation Commission (MTC)	Authorization to operate passenger ferries between Alameda and San Francisco; between San Francisco and the City of Emeryville; or service established by the CTC in the general vicinity of the San Francisco Bay Bridge
California Transportation Commission (CTC)	Authorization to operate passenger ferries between Alameda and San Francisco or in the vicinity of the San Francisco Bay Bridge
Public Utilities Commission (PUC)	"Vessel Common Carrier Certificate"
U.S. Coast Guard	Pilot licenses; Vessel certification
U.S. Corps of Engineers	Permit to construct facilities in navigatable waters of U.S.

Note: 1) This list is not exhaustive, but merely represents those agencies that came to MTC's attention during our preliminary investigations.
2) Other agencies that may need to be consulted by potential ferry operators include the State Air Resources Board, Water Quality Control Board, and Department of Fish and Game.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. Caltrans/California Transportation Commission will not permit a new transbay ferry service within ten miles of a state toll bridge whose revenues are pledged to repayment of bridge bonds. This includes all Bay crossings except Golden Gate. Any new ferry service that might be authorized by CTC would be required to pledge its revenues to retirement of existing bridge bonds.

2. Service which can be authorized by CTC, according to the Streets and Highways Code include:

   a) service between San Francisco and the City of Alameda;

   b) service in the general vicinity of the San Francisco-Oakland Bay Bridge established by the CTC;

   c) service operated by the City of Emeryville between Emeryville and San Francisco, with the consent of the bridge bond holders.

   d) service authorized by CTC when a toll bridge is obstructed because of accident or repair, or unable to fully accommodate traffic.

3. MTC Approval of ferry service is required for:

   a) CTC authorized service between San Francisco and the City of Alameda;

   b) service established by the CTC in the general vicinity of the San Francisco Bay Bridge;

   c) service operated by the City of Emeryville between Emeryville and San Francisco.

4. It is generally acknowledged that the Jones Act will not be amended to enable foreign built vessels to operate between points within U.S. waters. Any craft used for water transit in the San Francisco Bay must, therefore, be built in this country.

Recommendations

The following recommendations were approved by the Metropolitan Transportation Commission and are being incorporated in the Commission's 1985 Legislative program.

1. MTC should pursue legislative amendments to the Streets and Highways Code to remove language that restricts establishment of transbay ferry operations. (Sections 30350-30352, 30356, and 30358). The initial statute which requires this restrictive language dates back to 1929.

2. MTC should work with Caltrans and CTC to remove similar language from any new bonds on the Bay's toll bridges that restricts ferry service and to defease current bonds.

VI. ANALYSIS OF WATER TRANSIT PROPOSALS

INTRODUCTION

This section contains an analysis of the five proposals for water transit service which were documented in Chapter III of this report. Most of the service proposals are still in the conceptual stage. The location of terminals, docking requirements, exact routes and fares, schedules, and in some cases even the type of vehicle, have not been decided. Therefore, the following represents a preliminary analysis of the potential of high speed water transit service on the Bay. This report is not meant to take the place of the necessary feasibility studies, market analyses, and financial plans that are the initial steps to successful transit service implementation, and required by MTC if subsidy is to be provided.

For purposes of the analysis, the proposals have been aggregated into travel corridors. Table 5 presents a summary description of each of the travel corridors including a list of the operations being proposed in that corridor. The analysis includes a comparison of travel times and costs for different travel modes, a description of connecting transit services, and a summary of any legal or institutional issues that could affect the proposed service. Except in the case of the South Bay and Sonoma/Marin corridors, the figures used for high speed water transit fares have been provided by the proposers. For the South Bay to San Francisco and Sonoma/Marin to San Francisco routes, fare estimates have been provided by MTC, as the proposers did not supply this information. In the Sonoma/Marin and Pittsburg travel corridors, where proposers have indicated that a subsidy may be necessary, the analysis also includes estimates of patronage, as well as existing and projected population in market areas. Appendix B documents the methodology used to arrive at these estimates.

Each travel corridor is described below, followed by a brief discussion of the cost of transportation options and a summary of staff's conclusions with regard to high speed water transit in these corridors.

ALAMEDA TO DOWNTOWN SAN FRANCISCO

Service has been proposed from two points within this corridor -- Ballena Bay and Harbor Bay Isle Business Park. HBI Associates has proposed service from both points and Forum Hydrolines has proposed service from Harbor Bay Isle Business Park only. Neither operator has requested public subsidy at this time. AC Transit provides connecting service in the immediate vicinity of both Alameda terminal points. Terminals and parking facilities would have to be constructed.

Travel Times and Costs

Table 6 contains a comparison of the travel times and costs for competing modes on both of these routes. The competing travel modes in this corridor include auto, AC Transit bus service, and a combination of bus and BART. All travel times are assumed to be a.m. peak hour travel times arriving downtown San Francisco for an 8:30 a.m. work start. As the data indicates, high speed water transit (HSWT) provides the fastest door-to-door travel times at an estimated out-of-pocket cost below that of driving alone but higher than that of competing landside transit.

Table 5

TRAVEL CORRIDORS
Summary Descriptions

TRAVEL CORRIDOR	TERMINALS (1)	PROPOSER(s)	VESSEL TYPE
Alameda to Downtown San Francisco	Harbor Bay Isle Business Park	Harbor Bay Isle Associates Forum Hydrolines	Surface Effect Ship Hydrofoil
	Ballena Bay	Harbor Bay Isle Associates	Surface Effect Ship
Oakland Airport to San Francisco Airport	Oakland Airport & San Francisco Airport	Forum Hydrolines Pacific Transportation Systems	Hydrofoil Hovercraft
South Bay to Downtown San Francisco	Alviso	Pacific Transportation Systems	Hovercraft
Sonoma/Marin to Downtown San Francisco	Petaluma River, Bell Marin Keys, Santa Venecia, & Loch Lomond (2)	Supervisor Roumiguiere	Hovercraft
	Larkspur Ferry Terminal	Forum Hydrolines	Hydrofoil
Pittsburg/Martinez to Downtown San Francisco	Pittsburg	Pittsburg Chamber of Commerce Forum Hydrolines	Catamaran Hydrofoil
	Martinez	Pittsburg Chamber of Commerce	Catamaran

Notes:

(1) Except for the airport-to-airport route, the San Francisco terminal is assumed to be the Ferry Building.

(2) These four locations are used in the analysis as examples of possible terminals; the exact number and location of terminals in this corridor would await further study.

Table 6

Comparison of One-Way Travel Times and Costs for Competing Modes

Alameda to Downtown San Francisco (1)

ORIGIN	MODE	IN-VEHICLE TRAVEL TIME (2) (minutes)	DOOR-TO-DOOR TRAVEL TIME (3) (minutes)	TRANSIT FARE (4)	TOTAL COST (5)
Ballena Bay	Auto	38	48	--	$5.80
	Bus	30	42	$1.25	1.25
	Bus/BART	22	40	1.80	1.80
	HSWT	18	41	2.25	2.25
Harbor Bay Isle	Auto	42	52	--	6.20
	Bus	45	55	1.25	1.25
	Bus/BART	34	60	1.80	1.80
	HSWT	17	40	2.25	2.25

Notes:

(1) The Financial District is used as the downtown destination with an 8:30 a.m. work arrival time.

(2) For transit, includes primary transit modes--auto access not included;
Three minutes added at either end of HSWT trip for manuevering and docking;
San Francisco HSWT destination is Ferry Building Terminal;
Auto speed 20 mph for surface streets;
Highway speeds based on Caltrans observed am peak period travel times as of Fall, 1983.

(3) Includes in-vehicle travel time plus auto access and/or walk and wait time;
Seven minutes assumed for connecting and waiting at Alameda terminal; at origin, three minutes added to access auto;
At destination seven minutes assumed for time to park and walk to office or to walk from Ferry terminal to office.

(4) BART fare calculated to Montgomery Station; HSWT fare based on Forum Hydrolines' estimate

(5) Auto - 13 cents per mile (Bay Area average operating cost)
Parking - $150/month in San Francisco Financial District (one-half of average daily rate used)
Tolls - Bay Bridge: One-half of daily commute book rate ($.30)

(9565P)

Legal and Institutional Issues

Service from Alameda is restricted due to convenants placed on the bridge bonds. Neither proposed service can be operated until the bonds are defeased and then only if authorized by the California Transportation Commission and approved by MTC.

OAKLAND AIRPORT TO SAN FRANCISCO AIRPORT

Service from the Oakland Airport to the San Francisco Airport (SFO) has been proposed by both Forum Hydrolines and Pacific Transportation Systems. Forum is proposing hydrofoil service and Pacific Transportation Systems is proposing hovercraft service. Because of the shallow waters surrounding Oakland and San Francisco Airports, channel dredging would be required to allow for hydrofoil service. The amphibious nature of the hovercraft permits it to operate without channel dredging. Dredging costs were not made available to MTC, and the proposer has not indicated whether this expense has been reflected in the proposed fare. It is presumed that the HSWT operator would be responsible for dredging costs. Neither proposer is requesting subsidy. A terminal would need to be established at Oakland.

Travel Times and Costs

Table 7 presents a comparison of HSWT travel time and costs to current competing modes. It has been assumed that the market for this service would be east bay residents desiring access to San Francisco Airport (SFO). Therefore, Piedmont has been chosen as a sample point of origin. The competing modes for this service include limousine service from the Claremont Hotel to SFO, helicopter service from Oakland Airport to SFO, and private auto. Both the hydrofoil and hovercraft options offer approximately the same time and costs and are therefore shown together as HSWT in the table. In terms of door-to-door travel time, HSWT appears to be slower than all alternatives except limousine serive, but the total cost of HSWT appears to be less expensive than other transit modes. Neither proposer, however, has specified how access will be provided between airline terminals and docking facilities. Some sort of shuttle system will be necessary to provide this link, and the cost of this service will probably constitute additional fare for the patron.

Summary of UMTA Analysis

One of the documents produced for UMTA's High Speed Waterborne Transit Study was "An Assessment of the Potential for High Speed Waterborne Passenger Services in Selected United States Sites". The intent of this report was to select areas where HSWT could operate on a financially self-sustaining basis. In the Bay Area, four routes were initially selected for assessment: Larkspur to San Francisco via Tiburon, Oakland Airport to San Francisco Airport and downtown San Francisco, Richmond to San Francisco, and Redwood City to San Francisco. Of the four, only the Larkspur to San Francisco route was considered to be an economically viable HSWT operation.

Table 7

Comparison of One-Way Travel Times and Costs for Competing Modes

Oakland Airport to San Francisco Airport

ORIGIN	MODE	IN-VEHICLE TRAVEL TIME (1) (minutes)	DOOR-TO-DOOR TRAVEL TIME (2) (minutes)	TRANSIT Fare (3)	PARKING (4)	TOTAL COST (5)
Piedmont	Auto	35	58	--	$18 (S)	$22
	Limo (Hotel Claremont)	60	86	$13	13 (B)	28
	Helicopter	5	53	44	15 (O)	61
	HSWT	22	80	8	15 (O)	25

Notes:

(1) For transit, includes primary transit modes--auto access not included;
Three minutes added at either end of HSWT trip for manuevering and docking;
Auto speed 20 mph for surface streets;
Highway speeds based on Caltrans observed am peak period travel times as of Fall, 1983.

(2) Includes in-vehicle travel time plus auto access, and/or walk and wait time; 15 Minutes added for connection to limo, helicopter and HSWT;
20 minutes added for access to San Francisco Airport terminal from the off-site parking lot and HSWT terminals;
10 minutes added for access to San Francisco Airport terminal from helicopter pad.

(3) HSWT fare based on Forum Hydrolines' estimate

(4) Based on 3-day trip, daily rates:

(S) San Francisco Airport off-site parking at $6 per day
(B) Hotel Claremont at $4.25 per day
(O) Oakland Airport Long-Term Parking at $5 per day

(5) For Auto - 13 cents per mile (Bay Area average) plus one-half of Bay Bridge toll (30 cents)

For the Oakland Airport to San Francisco Airport and downtown San Francisco route, UMTA assumed that the existing transportation modes competing with this route would be BART, airport limousine service and the automobile. No capital public assistance was assumed for this route analysis. UMTA's analysis differs from MTC's in that the point of origin was assumed to be the Oakland Airport rather than a point in the East Bay such as Piedmont and UMTA assumed that Oakland Airport passengers accessing downtown San Francisco would also be served. The findings of UMTA's service analysis for this corridor are as follows:

- Water depth in the vicinity of the Oakland Airport limits craft to those drawing less than one foot of water. Air cushion vehicles are the only high speed craft which satisfy this restriction.

- To break even, a one-way daily ridership of 1,128 is necessary at a fare of $3.45 on an AP-188 craft. This represents 34 percent of the estimated total daily one-way ridership for Oakland Airport to San Francisco Airport and downtown San Francisco. A $5.20 fare is required to break even at a one-way daily ridership of 756 trips, or 23 per cent of the estimated existing market.

- This route is not considered financially feasible.

Legal and Institutional Issues

The existing Streets and Highways codes, as well as the bond covenants on the bridge preclude service from operating in this corridor. In order for service to be implemented, the State Legislature would have to amend the Streets and Highways codes, the existing bonds would have to be defeased, and the restrictive language would have to be removed from any subsequent bond covenants.

SOUTHBAY TO SAN FRANCISCO

Pacific Transportation Systems is proposing to operate hovercraft service from Alviso to the San Francisco Airport and to downtown San Francisco.

The Santa Clara County Transit District provides bus service to Alviso; these bus lines could probably be rerouted to serve a terminal in this area. A Terminal and parking facilities would have to be constructed. Pacific Transportation is not requesting a subsidy.

Travel Times and Costs

Table 8 presents a comparison of the HSWT a.m. peak hour travel times and costs to those of the auto and Caltrain. For analysis purposes, Sunnyvale was chosen as the point of origin. As the table illustrates, the door-to-door travel time for HSWT is faster than Caltrain, but slower than auto. The estimated out-of-pocket cost of HSWT is higher than Caltrain, but still considerably less than driving.

Legal and Institutional Issues

There are no known legal or institutional barriers. The proposed shoreline service is not in competition with any of the bridges and there are no known competing private carriers who might challenge the service.

Table 8

Comparison of One-Way Travel Times and Costs for Competing Modes

South Bay to Downtown San Francisco (1)

ORIGIN	MODE	IN-VEHICLE TRAVEL TIME (2) (Minutes)	DOOR-TO-DOOR TRAVEL TIME (3) (Minutes)	TRANSIT FARE	TOTAL COST (5)
Sunnyvale	Auto	57	67	--	$8.90
	Train	66	102	$1.91	2.27
	HSWT	59	91	4.00 (4)	4.65

Notes:

(1) The Financial District is used as the downtown destination with an 8:30 a.m. work arrival time.

(2) For transit, includes primary transit modes--auto access not included;
Three minutes added at either end of HSWT trip for maneuvering and docking;
San Francisco HSWT destination is Ferry Building Terminal;
Auto speed 20 mph for surface streets;
Highway speeds based on Caltrans observed am peak period travel times as of Fall, 1983.

(3) Includes in-vehicle travel time plus auto access and/or walk and wait time;
Seven minutes assumed for connecting and waiting at Alviso terminal; at origin three minutes assumed for access to auto;
At destination seven minutes assumed for time to park and walk to office or to walk from Ferry terminal to office.

(4) MTC fare estimate

(5) Auto - 13 cents per mile (Bay Area average operating cost)
Parking - $150/month in San Francisco Financial District (one-half of average daily rate used)

SONOMA/MARIN TO SAN FRANCISCO

Within this travel corridor, Forum Hydrolines has proposed service from the Larkspur Ferry Terminal to downtown San Francisco. Supervisor Roumiguiere has proposed that hovercraft be used to link Sonoma and Marin County commuters to downtown San Francisco via San Pablo Bay. Four potential sites along San Pablo Bay are being studied further as possible terminals:

- The mouth of the Petaluma River
- Bel Marin Keys
- Santa Venetia
- Loch Lomond

Transit service in the vicinity of the Santa Venetia and Loch Lomond proposed terminal points is provided by Golden Gate Transit. Some schedule and route modifications would be necessary to serve these terminals. The Petaluma River and Bel Marin Keys proposed terminal sites are not presently served by public transit. All proposed terminal sites would require development of a terminal and parking facilities. While Forum has not indicated that public subsidy would be required for their proposed service, Supervisor Roumiguiere's proposal will probably involve a public subsidy. This corridor has therefore been analyzed for possible patronage.

Travel Times and Cost

Travel times and fares have been analyzed not only for an area directly adjacent to the terminal point, but also from several market areas that Supervisor Roumiguiere anticipates will provide patrons to the Petaluma River terminal. These areas are Santa Rosa, Petaluma and Novato. Table 9 contains a summary of the travel times and costs of the available modes. The data indicates that the door-to-door HSWT travel time is faster than alternative transit but slower than the automobile from those points of origin not within close proximity to a terminal. In general, when the terminal is close to the point of origin, the total travel time for HSWT is faster than all competing modes. For example, San Rafael, Bel Marin Keys and Loch Lomond all have faster travel times by HSWT than other modes. However, the availability of freeway access can also significantly decrease the total auto travel time, thus making the automobile faster as in the case of Santa Venetia. In every case the HSWT in-vehicle travel time is faster than all of the alternatives. In all cases the total out-of-pocket cost of HSWT is less than the auto, but more than other transit modes.

Legal and Institutional Issues

There are no local barriers to implementing service in this corridor. However, existing private carriers as well as the Golden Gate Bridge District may protest such competition to the Public Utilities Commission.

Estimated Patronage

Patronage for HSWT in the Sonoma/Marin corridor, displayed in Table 10, was estimated based on 1980 census data and MTC commuter projections for Year 2000 coupled with MTC's mode choice model. Four potential market areas for the proposed HSWT service were delineated in the corridor. A map illustrating the boundaries of each area is contained in Figure 3. The total number of commuters from each of these market areas to the downtown San Francisco destination area was determined from the 1980 census data and MTC's Year 2000

Table 9

Comparison of One-Way Travel Times and Costs for Competing Modes

Marin/Sonoma to Downtown San Francisco (1)

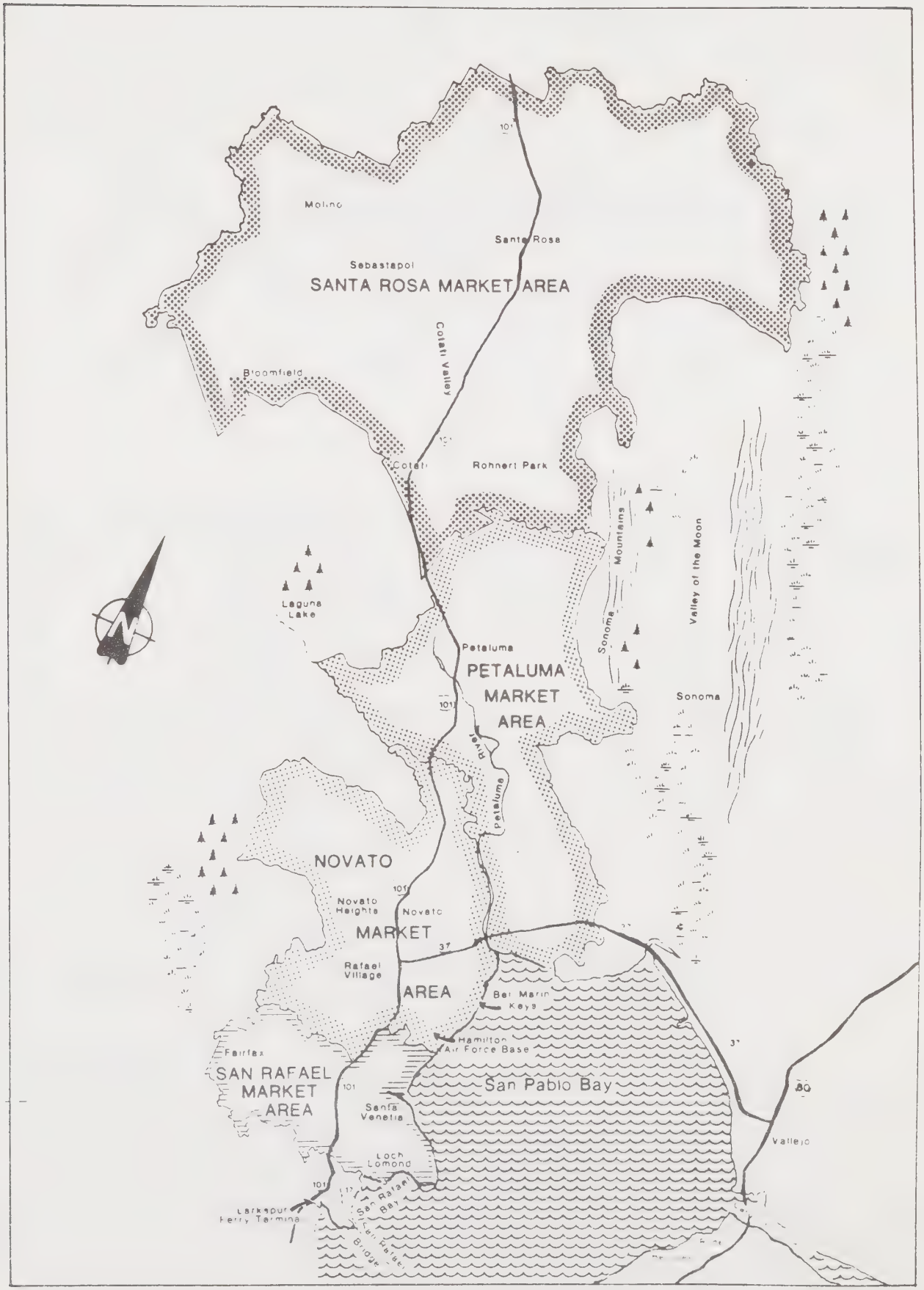
ORIGIN	MODE	IN-VEHICLE TRAVEL TIME (2) (Minutes)	DOOR TO DOOR TRAVEL TIME (3) (Minutes)	TRANSIT FARE (4)	TOTAL COST (5)
Santa Rosa					
	Auto	85	95	--	$11.30
	Bus	126	146	$3.70	3.70
	HSWT	42	98	2.50	6.00
Petaluma					
	Auto	66	76	--	9.72
	Bus	105	129	3.35	3.35
	HSWT	42	79	2.50	4.65
Novato					
	Auto	56	66	--	7.50
	Bus	80	94	2.55	2.55
	HSWT	42	80	2.50	4.15
Bel Marin Keys					
	Auto	56	66	--	7.55
	Bus	62	76	2.55	2.75
	HSWT	42	62	2.50	2.63
Santa Venetia					
	Auto	40	50	--	6.90
	Bus	66	76	2.20	2.20
	HSWT	32	52	2.50	2.63
Loch Lomond					
	Auto	46	56	--	7.03
	Bus	60	70	2.20	2.20
	HSWT	27	44	2.50	2.50
San Rafael					
	Auto	46	56	--	6.65
	Bus	60	72	2.20	2.20
	GGB Ferry	45	68	2.20	2.60
	HSWT	31	54	2.75	3.15

Notes:

(1) The Financial District is used as the downtown destination with an 8:30 a.m. work arrival time;
(2) For transit, includes primary transit modes--auto access not included;
Three minutes added at either end of HSWT trip for maneuvering and docking;
San Francisco HSWT destination is Ferry Building Terminal;
Auto speed 20 mph for surface streets;
Highway speeds based on Caltrans observed am peak period travel times as of Fall, 1983.
(3) Includes in-vehicle travel time plus auto access and/or walk and wait time;
Seven minutes assumed for connecting and waiting at Marin-Sonoma terminals; at origin, three minutes added for access to auto;
At destination seven minutes assumed for time to park and walk to office or to walk from Ferry terminal to office.
(4) HSWT fares are MTC estimates
(5) Auto - 13 cents per mile (Bay Area average operating cost)
Parking - $150/month in San Francisco Financial District (one-half of average daily rate used)
Tolls - Golden Gate: One-half of average daily rate ($.60)

FIGURE 3

NORTH BAY MARKET AREA



estimates. The boundaries of the downtown destination area are illustrated in Figure 4. It was assumed that the typical commuter using HSWT would work within walking distance of the Ferry Building. This area currently employs approximately 199,000 people. The total number of commuters from all four of the market areas to the downtown San Francisco destination was 10,144 in 1980, and is projected to increase to 15,247 in Year 2000. These numbers are broken down by market area in Table 10.

Table 10 also contains the current modal choice in each market area, and compares them to the estimated transit modal choice with the implementation of the proposed HSWT service. As the data indicates, HSWT service would increase the overall number of commuters using transit only slightly in Santa Rosa and San Rafael, would have no affect on total transit use in Novato, but would increase transit use substantially in the Petaluma market area. The number of estimated patrons diverted from other modes, contained in Table 10, also illustrates that only in the case of Petaluma will the total number of transit users substantially increase. This increase in Petaluma is due to the assumed implementation of HSWT at the mouth of the Petaluma River, which offers commuters an improved service over available transit.

In the case of San Rafael, most of the patronage would probably be diverted from the Larkspur Ferry.

The projected total patronage of 1500 in 1980 and 2700 in 2000 for the Santa Rosa, Petaluma, and Novato market areas indicate that there may be a sufficient market to warrant HSWT implementation in this corridor. Further detailed study will be necessary to determine the cost-effectiveness of such a service. In general, however, HSWT will not have a significant affect on highway congestion as the majority of the patrons will be diverted from other transit modes.

Profit/Loss Analysis

Using MTC's patronage projections, the Golden Gate Bridge District Ferry Division prepared a profit/loss analysis for two High Speed Water Transit service options. Both options assume service from the mouth of the Petaluma River to the San Francisco Ferry Building. The first assumes the use of a Nichols Brothers 400-passenger catamaran, and the second an 88-passenger British Hovercraft design. In both cases, the service would carry approximately 3000 daily passengers at a one-way fare of $3.35. Table 11 summarizes the estimated revenues and costs for both services.

Because of the relatively small passenger seating capacity of the hovercraft, this service would require 22 vessels, including spares, to accommodate the 3000 daily passengers. The 400-passenger catamaran could provide the same service with only 4 vessels. Due to the amphibious nature of the hovercraft, channel dredging is not necessary. The catamaran, on the other hand, requires that a channel be dredged in order to implement the service, and that maintenance dredging be performed every three years thereafter.

Dispite the dredging costs associated with the catamaran, the catamaran service is considerably less expensive to operate than hovercraft service, because the catamaran has lower capital and operating costs and the catamaran service requires considerably fewer vessels to operate. According to the profit/loss analysis, the catamaran service can expect to recover 72% of its yearly operating costs from revenue. The hovercraft is estimated to recover

only 19% of its operating costs from revenue. Looking at both the operating and amortized capital costs of both projects, the catamaran is estimated to have a yearly deficit of $4 million, and the hovercraft's yearly deficit is estimated at $19.3 million.

The Golden Gate Bridge District staff also developed similar profit and loss information for provision of bus service for the 3000 daily North Bay passengers. This information is based on the District's present experience serving these geographical areas and assumes current fares. Capital costs are limited to the 46 vehicles that would be required to provide this service. No attempt has been made to account for supplemental equipment or facilities required to support the additional fleet because of the myriad approaches available for financing the expensing of such costs. Table 11 summarizes the estimated revenues and costs for this service. Based on these estimates, the farebox recovery rate for this service would be approximately 49%, which is consistent with the bus system's present farebox recovery rate. Looking at both the operating and amortized capital costs of new bus service, a yearly deficit of $4.4 million is projected.

Golden Gate staff cautions readers against making simple comparisons between the estimates for the bus service and the high speed water transit. "The costs of the bus system could vary depending on commute traffic conditions, i.e., whether the buses have exclusive lanes which would permit productive uses in other commute services. The potential for using buses or drivers in midday service would also impact costs allocated to the commute services. The capital cost of improvements to support the service such as park-and-ride lots, shelters, or increased maintenance or operating facilities would also have their impacts." Table 11 includes both incremental costs and a portion of fixed costs associated with these services.

Summary of UMTA's Analysis

UMTA's HSWT domestic site analysis for the San Francisco Bay provides profit (loss) data on a service assumed to operate from the Larkspur Ferry Terminal. While the analysis does not look at a service from northern Marin, as with Supervisor Roumiguiere's proposal, it provides some insights with regard to the profitability of a high speed service in this corridor.

In analyzing vessels for the Larkspur route, UMTA considered hydrofoils, surface effect ships, and catamarans. The amphibious air cushioned vehicle (AP1-88) being proposed by Supervisor Roumiquiere was not considered by UMTA because wave heights in the North Bay frequently exceed three feet, and passenger comfort cannot be maintained above this level in the AP1-88. Table 12 from the UMTA report shows the results of their financial analysis. Pertinent findings of UMTA's Larkspur to San Francisco service analysis and MTC staff's conclusions with respect to this analysis are as follows:

- UMTA estimates peak period one-way ridership could range from 800 to 1,230 passengers (depending on boat speed) at a fare of $2. MTC's estimate for patronage from Larkspur is 1100 passengers assuming a fare of $2.75. The two patronage estimates are relatively consistent, but our estimates suggest a lesser sensitivity to fare than UMTA's.

Table 10

Projected High Speed Water Transit Patronage
Sonoma/Marin to Downtown San Francisco

1980

Market Area (1)	Population (2)	Daily Commuters to San Francisco (3)	Mode Split Without HSWT (Percent) Auto	Shared Ride	Transit	Estimated Transit Mode Split with HSWT (4) (Percent) Total Transit	HSWT	Landside	Estimated Number of HSWT Patrons (Rounded)	Estimated Number of Commuters Diverted to HSWT (Rounded) From Auto or Shared Ride	From Existing Transit
Santa Rosa	171,449	1,166	27	29	44	48 =	27 +	21	300	50	250
Petaluma	36,366	1,112	19	33	47	69 =	48 +	21	500	250	250
Novato	56,517	3,189	23	29	48	48 =	21 +	27	700	0	700
San Rafael	62,909	4,680	30	15	54	56 =	23 +	33	1,100	100	1,000
Total	327,241	10,144							2,600	400	2,200

2000

Market Area	Population	Daily Commuters to San Francisco (5)	Mode Split Without HSWT (6) (Percent) Auto	Shared Ride	Transit	Estimated Transit Mode Split with HSWT (7) (Percent) Total Transit	HSWT	Landside	Estimated Number of HSWT Patrons (Rounded)	Estimated Number of Commuters Diverted to HSWT (Rounded) From Auto or Shared Ride	From Existing Transit
Santa Rosa	243,809	2,087	27	29	44	48 =	27 +	21	600	80	520
Petaluma	59,223	2,270	19	33	47	69 =	48 +	21	1,100	500	600
Novato	71,943	4,806	23	29	48	48 =	21 +	27	1,000	0	1,000
San Rafael	57,356	6,084	30	15	54	56 =	23 +	33	1,400	120	1,280
Total	432,331	15,247							4,100	700	3,400

Notes:

(1) See Figure 3 for definition of Market Areas. San Rafael assumes service would originate from Larkspur. All others assume service from Petaluma River
(2) ABAG Projections '83
(3) 1980 Census Urban Transportation Planning Package 7/6/84
(4) Percent of total trips rounded
(5) MTC Commuter Projections based on ABAG Projections '83
(6) 1980 Observed Mode Split Assumed for Year 2000
(7) 1980 Estimated Mode Split with HSWT Assumed for Year 2000
(9565P)

Table 11

PETALUMA RIVER TO DOWNTOWN SAN FRANCISCO
PROFIT/LOSS ANALYSIS
(in thousands)

	High Speed Water Transit		Bus Transit
	400-Passenger Catamaran	88-Passenger Hovercraft (AP-188)	41-Passenger Bus
Revenues:			
Operating Revenue[1]	$ 2,089	$ 2,089	$ 1,928
Expenses:			
Crew/Drivers	1,407[2]	5,896[3]	2,000[4]
Repairs	133[5]	1,100[6]	
Fuel	324[8]	1,365[9]	1,138[7]
Insurance	200	1,000	
Other Vessel (inc. dry docking)	110	195	
Total Vessel Expense	2,174	9,556	3,138
Terminal Personnel	205	205	
Utilities	20	20	
Terminal Other (operating supplies, lease)	148	148	
Total Terminal Expense	373	373	
Corporate Administration & Overhead	370	1,010	785
Total Operation Expense	2,917	10,939	3,923
Farebox Recovery Rate (Ratio of Est. Revenue to Operating Cost)	72%	19%	49%
Interest on Capital[10]	1,606	5,165	1,628
Depreciation[11]	1,556	5,320	736
Total Expense	6,079	21,424	6,287
Deficit	($ 3,990)	($19,335)	($ 4,359)

[1]For HSWT assumes market of 1,500 passengers x 2 = 3,000 fares per day at 260 days at $3.35. Seasonal variations have been assumed for HSWT based on Bridge District experience for total of 621,000 annual passengers; for bus transit revenues have been adjusted to account for discount fares (elderly, handicapped, students); base ticket fares are:

Santa Rosa $3.33 (600 daily trips)
Petaluma 3.02 (1,000 daily trips)
Novato 2.30 (1,400 daily trips)

[2]Personnel necessary to operate 4 boats (including spares). Based on Bridge District labor rates.

[3]Personnel necessary to operate 22 boats (including spares). Based on Bridge District labor rates.

[4]Personnel to operate 46 buses (including spares).

[5]Maintenance for Catamaran = $35.00 per hour.

[6]Maintenance for Hovercraft = $74.00 per hour.

[7]Maintenance, fuel, and fleet overhead @ $1.23/mile.

[8]Fuel for Catamaran = $85.00 per hour.

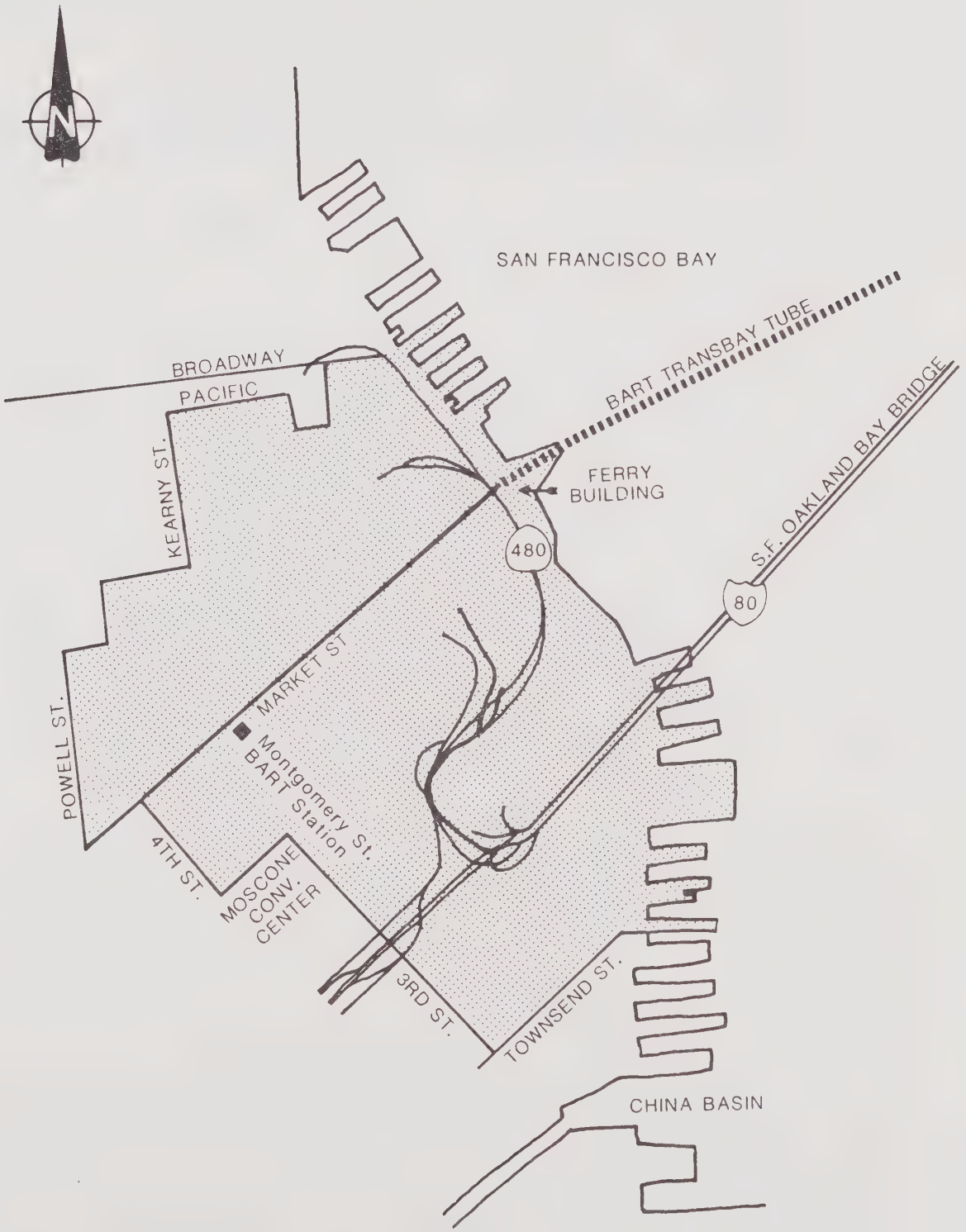
[9]Fuel for Hovercraft = $91.00 per hour.

[10]Includes the cost of vehicles (catamaran @ $1.8 million; hovercraft @ $2.5 million; bus @ $200,000), ferry terminal, and both initial and maintenance dredging (in the case of the Catamaran; annualization assumes 12% interest rate, 10 year loan.

[11]20% salvage value after 10 years.

FIGURE 4

San Francisco Destination Area



- UMTA estimates no craft will earn a profit on this route if current Larkspur ferry fares ($2.20) are charged and if all capital costs are borne by the operator. Capital costs include vessels only, since terminal and channel facilities already exist at Larkspur. However, catamaran service could earn a profit if a $3 fare were charged and patronage remains at the level estimated with a $2.20 fare.

- Based on UMTA figures, if 75 percent of the capital costs were subsidized on the Larkspur route, the catamaran could operate profitably at the current Larkspur ferry fare.

- The more exotic vessels, hydrofoils and hovercraft, have higher operating costs. While these vessels have speed advantages over the catamaran, UMTA data indicates they are not financially feasible on this route.

- UMTA considers the Larkspur route financially feasible with capital assistance using a catamaran.

UMTA's findings are sensitive to their patronage estimating methodology, which uses fare as the most critical variable and represents relationships between fare and patronage that do not seem to be supported by our findings with regard to the Larkspur ferries (i.e., frequency of service is the critical variable, not fare). If patronage is less sensitive to fare than UMTA estimates, a higher fare may be possible as suggested in the second bullet above, and a Larkspur HSWT service may be able to break-even without a capital subsidy. It should also be noted that the North Bay market area for UMTA's analysis was much smaller than that used for MTC's analysis, while their San Francisco destination area was larger. MTC confines its destination to the financial district or points within seven minutes walk of the Ferry Building. UMTA, by contrast used the entire greater downtown area for its San Francisco destination. Origin points for their analysis were in the immediate vicinity of Larkspur and south Tiburon. MTC's market extends from San Rafael north to Santa Rosa and assumed service from a northern Marin terminal as well as Larkspur. Therefore, more detailed patronage analysis coupled with an economic feasibility analysis would be necessary to determine the financial viability of a Marin to downtown San Francisco HSWT service.

Nevertheless, UMTA's findings do suggest that it may be difficult to provide a cost-effective Marin HSWT service to commuters. This finding seems consistent with the review of worldwide operations (Chapter III) where it was found that no current operator competes with an extensive highway and landside transit system, as in the Bay Area.

PITTSBURG/MARTINEZ TO SAN FRANCISCO

Within this corridor there are two proposals for service. The first, by the Pittsburg Chamber of Commerce, is to have Blue and Gold operate catamaran service from Pittsburg to Martinez to the San Francisco Ferry Building. This proposal would involve a $4.00 per one-way trip subsidy. Forum Hydrolines has also proposed to provide hydrofoil service from Pittsburg to the Ferry Building without public subsidy. Tri-Delta Transit provides connecting bus service to the proposed Pittsburg terminal. County Connection and BART express buses provide transit access in the vicinity of the proposed Martinez terminal. Parking facilities and a terminal would need to be constructed.

Table 12

LARKSPUR - SAN FRANCISCO
FLEET CHARACTERISTICS SUMMARY
(Financials in Thousands of 1983 $ Unless Noted Otherwise)

WITHOUT 75% CAPITAL ASSISTANCE

Craft	Size of Fleet	Peak Period Trips / Patronage Each Way		Fare (1)	Annual Ridership	Annual Revenue	Capital (2)	Annual Costs Fixed	Annual Costs Operating	Total	Annual Net
HYDROFOIL											
RHS-150	2	6	1,080	$2.05	707,400	$1,450	$1,380	$150	$1,141	$2,671	($1,221)
SES											
BH-340	2	4	1,232	$1.90	807,000	$1,533	$1,537	$150	$1,388	$3,075	($1,542)
CATAMARAN											
JC-F1	2	5	1,075	$2.05	704,000	$1,443	$1,160	$150	$1,133	$2,443	($1,000)
W-86	2	4	800	$2.40	524,000	1,257	$626	$150	$750	$1,526	($269)
W-95	2	5	1,090	$2.05	714,000	$1,465	$783	$150	$1,087	$2,020	($555)
29 Meter	2	4	972	$2.10	637,000	$1,338	$642	$150	$725	$1,517	($179)

WITH 75% CAPITAL ASSISTANCE

Craft	Size of Fleet	Peak Period Trips / Patronage Each Way		Fare	Annual Ridership	Annual Revenue	Capital	Annual Costs Fixed	Annual Costs Operating	Total	Annual Net
HYDROFOIL											
RHS-150	2	6	1,080	$2.05	707,400	$1,450	$345	$150	$1,141	$1,636	($186)
SES											
BH-340	2	4	1,232	$1.90	807,000	$1,533	$384	$150	$1,388	$1,923	($390)
CATAMARAN											
JC-F1	2	5	1,075	$2.05	704,000	$1,443	$290	$150	$1,133	$1,573	($130)
W-86	2	4	800	$2.40	524,000	1,257	$157	$150	$750	$1,056	$201
W-95	2	5	1,090	$2.05	714,000	$1,465	$196	$150	$1,087	$1,433	$32
29 Meter	2	4	972	$2.10	637,000	$1,338	$161	$150	$725	$1,035	$303

(1) Fares displayed were selected using UMTA's patronage model to produce the highest revenue potential.

(2) Annualization of capital cost assumes 12% interest rate, 10-year loan, and a 20% salvage value after 10 years. Includes cost of vessels only.

SOURCE: UMTA, "An Assessment of the Potential for High Speed Waterborne Passenger Services in Selected United States Sites", September, 1984.

Travel Times and Cost

As Table 13 indicates, the HSWT travel time from Pittsburg is slower than the auto or the combination of auto and BART. In the case of the catamaran service proposed by the Chamber of Commerce, HSWT is also slower than the combination of bus and BART. The out-of-pocket cost of HSWT is competitive with the auto/BART combination, but slightly higher than the bus/BART option. In the case of Martinez, where only catamaran service has been proposed, travel time for HSWT is more than the auto and equal to a combination of bus/BART. From Martinez, the out-of-pocket cost of HSWT is substantially more than bus/BART, but less than the auto.

Legal and Institutional Issues

The convenants on the bridge bonds and the existing Streets and Highways codes preclude operating from Pittsburg and Martinez to San Francisco. In order for service to be implemented, the legislature will have to amend the code and the bonds must be defeased.

Estimated Patronage

Three market areas have been designated in this corridor; Pittsburg, Martinez, and Benicia. Figure 5 illustrates the boundaries of these areas. Patronage estimates were made based upon the total number of commuters from each of these market areas to the downtown San Francisco destination area previously described and illustrated in Figure 4. Table 14 contains the number of commuters from each market area traveling in this corridor for 1980 and 2000, current and projected transit modal choice, and estimates of HSWT patronage for 1980 and 2000. These estimates were made assuming implementation of the catamaran being proposed by the Pittsburg Chamber of Commerce.

There are currently an estimated 2,000 commuters in all three market areas traveling to the downtown San Francisco destination area. This number is projected to increase to 4,000 by 2000. This is a relatively small proportion of the total household population of 157,000 currently residing in these areas.

An indicated in Table 14, the total number of transit riders will not increase with HSWT. All of the estimated patrons would be diverted from existing transit service. This is due to the fact that HSWT is neither faster nor cheaper than BART. Even if the hydrofoil service proposed by Forum were to be implemented, the overall travel time and cost would still not be able to improve upon BART and the total number of transit riders would remain the same, although the HSWT share in Pittsburg would increase from 11% to 14%. Thus implementation of HSWT in this corridor will not produce a positive affect upon traffic congestion.

According to 1980 census data, the majority of Pittsburg residents do not commute to San Francisco. The majority of commuters in the Pittsburg area are employed within Contra Costa County. Of the 40,000 1980 commuters leaving the greater Pittsburg area, 33,500 are heading for destinations within Contra Costa County. MTC projections indicate that in the Year 2000, of the 92,500 projected commuters, 72,000 will commute to destinations within Contra Costa County, 12,000 will commute to Alameda County, and only 4,300 will commute to San Francisco County.

Patronage for the catamaran service from all three market areas is estimated at 250 daily commuters in 1980 and 500 daily commuters in 2000. If the hydrofoil service were to be implemented this patronage would only increase slightly to 285 and 580, respectively.

Table 13

Comparison of One-Way Travel Times and Costs for Competing Modes

Pittsburg/Martinez to Downtown San Francisco (1)

ORIGIN	MODE	IN-VEHICLE TRAVEL TIME (2) (Minutes)	DOOR-TO-DOOR TRAVEL TIME (3) (Minutes)	TRANSIT FARE (4)	TOTAL COST (5)
Pittsburg	Auto	75	85	--	$9.75
	Bus/BART	85	106	$2.85	3.00
	Auto/BART	49	86	1.95	4.55
	HSWT - Catamaran	90	119	4.00	4.80
	HSWT - Hydrofoil	76	105	4.00	4.80
Martinez	Auto	68	78	--	8.68
	Bus/BART	75	94	2.55	2.55
	HSWT	75	94	4.00	4.10

Notes:

(1) The Financial District is used as the downtown destination with an 8:30 a.m. work arrival time.

(2) For transit, includes primary transit modes -- auto access not included;
Three minutes added at either end of HSWT trip for maneuvering and docking;
San Francisco HSWT destination is Ferry Building Terminal;
Auto speed 20 mph for surface streets;
Highway speeds based on Caltrans observed am peak period travel times as of Fall, 1983.

(3) Includes in-vehicle travel time plus auto access and/or walk and wait time;
Seven minutes assumed for connecting and waiting at Pittsburg/Martinez terminals;
At destination seven minutes assumed for time to park and walk to office or to walk from Ferry terminal to office.

(4) BART fare calculated to Montgomery Station; HSWT fares are proposer's estimate

(5) Auto - 13 cents per mile (Bay Area average operating cost)
Parking - $150/month in San Francisco Financial District (one-half of average daily rate used)
Tolls - Bay Bridge: One-half of daily commute book rate ($.30)

FIGURE 5

EAST CONTRA COSTA MARKET AREA

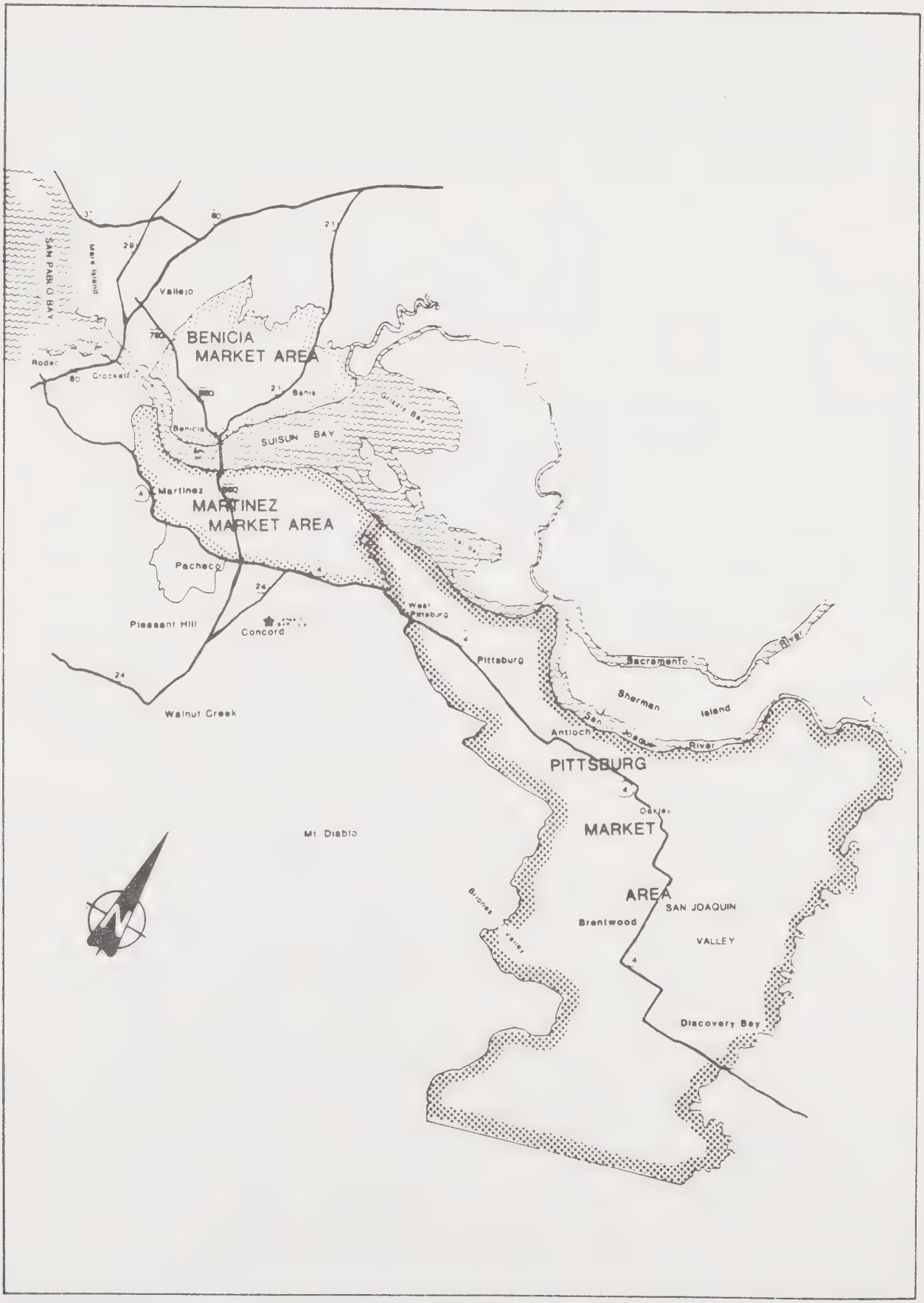


Table 14

Projected High Speed Water Transit Patronage
Pittsburg/Martinez to Downtown San Francisco

1980

Market Area (1)	Population (2)	Daily Commuters to San Francisco (3)	Mode Split Without HSWT (Percent) Auto	Shared Ride	Transit	Estimated Transit Mode Split with HSWT (4) (Percent) Total Transit	HSWT	Landside	Estimated Number of HSWT Patrons (Rounded)	Estimated Number of Commuters Diverted to HSWT (Rounded) From Auto or Shared Ride	From Existing Transit
Pittsburg	108,071	954	20	41	39	39 =	11 +	28	100	0	100
Martinez	31,905	671	29	21	50	50 =	17 +	33	120	0	120
Benicia	16,587	327	28	42	30	30 =	10 +	20	30	0	30
TOTAL	156,563	1,952							250	0	250

2000

Market Area	Population	Daily Commuters to San Francisco (5)	Mode Split Without HSWT (6) (Percent) Auto	Shared Ride	Transit	Estimated Transit Mode Split with HSWT (7) (Percent) Total Transit	HSWT	Landside	Estimated Number of HSWT Patrons (Rounded)	Estimated Number of Commuters Diverted to HSWT (Rounded) From Auto or Shared Ride	From Existing Transit
Pittsburg	195,332	2,175	20	41	39	39 =	11 +	28	250	0	250
Martinez	42,563	1,126	29	21	50	50 =	17 +	33	200	0	200
Benicia	27,230	760	28	22	30	30 =	10 +	20	100	0	100
TOTAL	265,125	4,061							550	0	550

Notes:

(1) See Figure 5 for definition of Market Areas
(2) ABAG Projections '83
(3) 1980 Census Urban Transportation Planning Package 7/6/84
(4) Percent of Total Trips Rounded
(5) MTC Commuter Projections based on ABAG Projections '83
(6) 1980 Observed Mode Split Assumed for Year 2000
(7) 1980 Estimated Mode Slit With HSWT Assumed for Year 2000

(9565P)

COST OF TRANSPORTATION OPTIONS

The following are typical unit capital costs for some of the transportation alternatives to HSWT. It is difficult to compare these alternatives as they are not measured in uniform terms, nor do they offer the same amount of capacity. However, this does give the reader an idea of the order of magnitude of the range of costs of the various options.

- 94 passenger AP-188 Hovercraft - $2,500,000
- 81 passenger Forum Hydrofoil - $950,000
- 400 passenger Nichols Brothers Catamaran - $1,800,000
- 40 passenger bus - $180,000-$200,000

CONCLUSIONS

The conclusions have been summarized by travel corridor and are presented below:

Alameda to Downtown San Francisco

- Based on travel time and projected fares, HSWT appears to provide an alternative to driving alone that is both faster and cheaper.

- To operate this service, the bridge bonds must be defeased, and CTC and MTC approval is required.

Oakland Airport to San Francisco Airport

- Total travel time by HSWT is longer than most other modes in this corridor.

- Although the fare is estimated to be less than other transit alternatives, access from docking facilities to airline terminals has not been included in the cost figures.

- In the case of the hydrofoil being proposed by Forum, channel dredging will be necessary. The cost and funding source for dredging have not as yet been identified.

- UMTA's analysis of service from Oakland Airport to the San Francisco Airport and downtown San Francisco concluded that such service would not be financially feasible.

- To operate this service, the legislature would have to amend the Streets and Highways code, existing bonds would have to be defeased, and the restrictive language would have to be removed from any subsequent bond covenants.

South Bay to San Francisco

- Proposed hovercraft service in the corridor would be faster but more expensive than Caltrain and slower and less expensive than the automobile.

- Access to the Alviso terminal could be a problem for patrons due to limited transit access, congested roadways, and the remote location of the terminal.

- There are no known legal barriers to this service.

Sonoma/Marin to Downtown San Francisco

- The four market areas of Santa Rosa, Petaluma, Novato, and San Rafael are estimated to provide 2,600 daily HSWT patrons in 1980 and 4,000 in 2000.

- Santa Rosa, Petaluma, and Novato market areas may provide sufficient patronage to warrant HSWT implementation in this corridor. However, further study is necessary to determine the cost-effectiveness of the proposed service.

- HSWT could slightly increase the total number of commuters using transit in the Santa Rosa and San Rafael areas.

- Implementation of HSWT from the mouth of the Petaluma River or another terminal in the vicinity could substantially increase transit mode split from the Petaluma market area.

- HSWT from San Rafael would likely divert patrons from the Golden Gate Bridge Larkspur Ferry without substantially increasing the total number of transit users.

- HSWT will not have a significant affect on highway congestion as the majority of patrons will be diverted from other transit modes.

- A profit-loss analysis was performed for catamaran and hovercraft service from the mouth of the Petaluma River to downtown San Francisco, and for bus service from Santa Rosa, Petaluma, and Novato to downdown San Francisco. The results of this analysis show that the estimated farebox recovery rate (revenues divided by operating costs) of the catamaran are the most favorable, although all services would operate at a deficit. Estimates of the respective farebox ratios are: 400-passenger catamaran 72%, 88-passenger hovercraft 19%, and bus 49%.

- As part of its nationwide study, UMTA analyzed a service from Larkspur to San Francisco, finding the route to be financially feasible with capital assistance using a catamaran. UMTA data indicates that hydrofoils and hovercraft are not financially feasible on this route due to the higher operating costs associated with these vessels.

- UMTA's Larkspur to San Francisco route analysis did not consider the amphibious air cushioned vehicle (AP-188) being proposed by Supervisor Roumiguiere because wave heights in the north Bay frequently exceed the three foot level. According to UMTA, passenger comfort cannot be obtained above this level in the AP-188.

- There are no known legal barriers to HSWT services in the Sonoma/Marin to San Francisco corridor.

Pittsburg/Martinez to Downtown San Francisco

- HSWT will not increase the total transit ridership.

- HSWT has a higher out-of-pocket cost and longer travel time than BART.

- Implementation of HSWT in this corridor will not reduce traffic congestion on freeways near Pittsburg. Evidence suggests that most Pittsburg residents do not commute to San Francisco. The majority of commuters in the Pittsburg area commute to employment within Contra Costa County.

- Patronage estimates may be sufficient to warrant one daily round trip commute run. However, the experience of other water transit operators indicates that this level of service may not be adequate to attract and keep patronage.

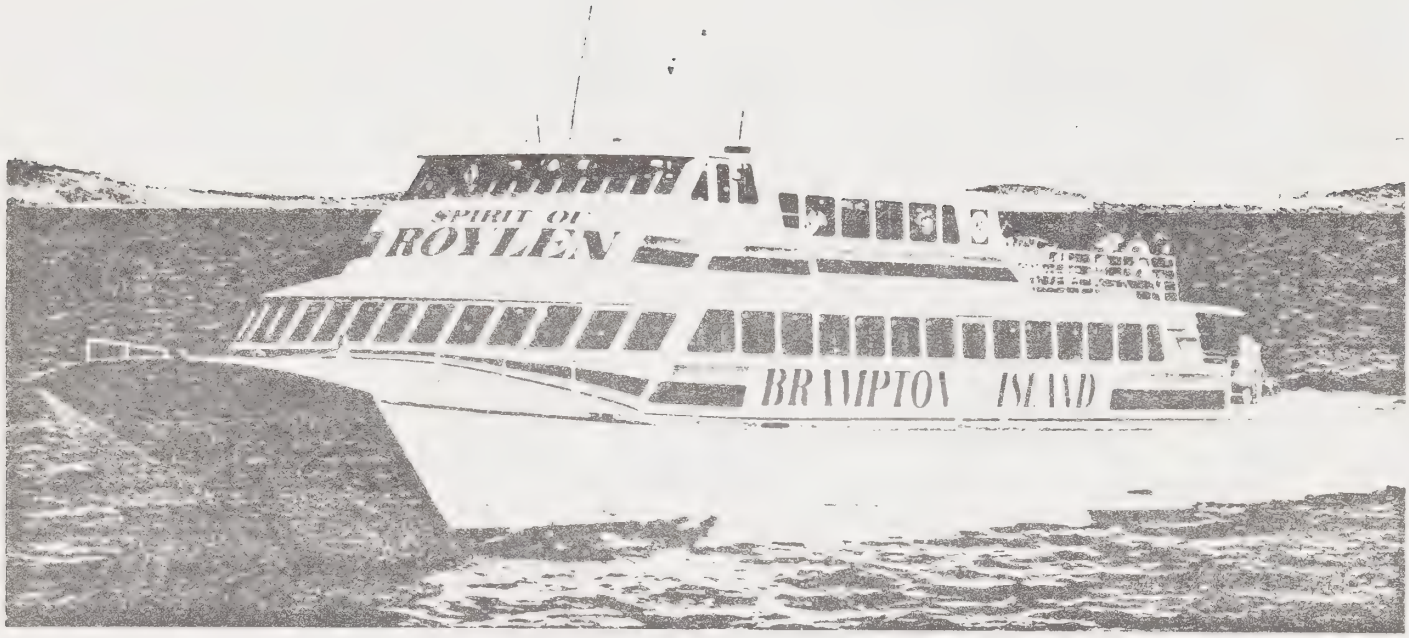
- To operate this service, the legislature must amend the Streets and Highways code, existing bonds would have to be defeased, and the restrictive language would have to be removed from any subsequent bond covenants.

APPENDIX A

Operating Characteristics of Selected

High Speed Marine Transit Vehicles

Source: "Technical Memorandum, An Assessment of High Speed Waterborne Vessels & Their Builders; 1983, prepared for Urban Mass Transportation Administration by: Advanced Marine Systems Assoc., Inc. in cooperation with Pert, Merwick and Mitchell Company.



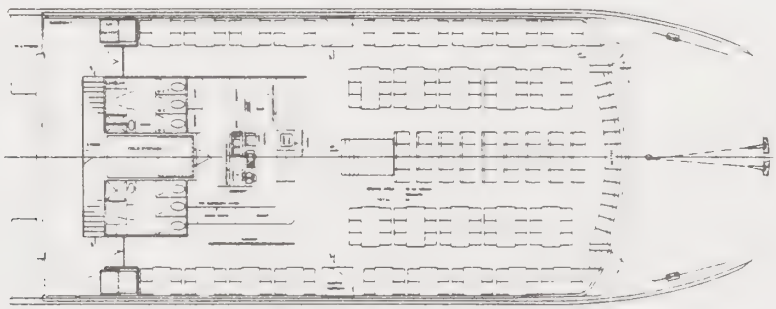
29-Meter Ferry **CATAMARAN**

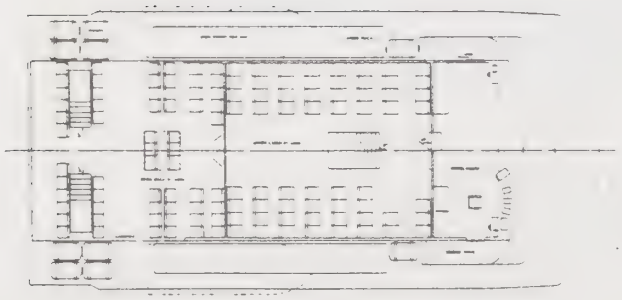
International Catamarans Pty. Ltd., Hobart, Tasmania, Australia

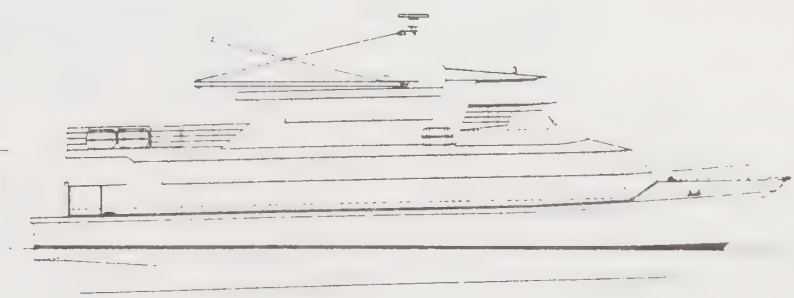
Dimensions:	
Length, over all	96' 2"
Beam, Hull	36' 9"
Draft	4' 11"
Displacement:	88.4 tons
Gross Reg. Tonnage:	N/A
Speed, Maximum:	26 Kts
Cruise:	24 Kts
Passenger Cap'y, Max:	243

Propulsion Plant:
2 × MWM model TBD 604 V8 Marine Diesels
2 × fixed pitch propellers

Electrical Plant:
2 × 25 kVA diesel driven generators

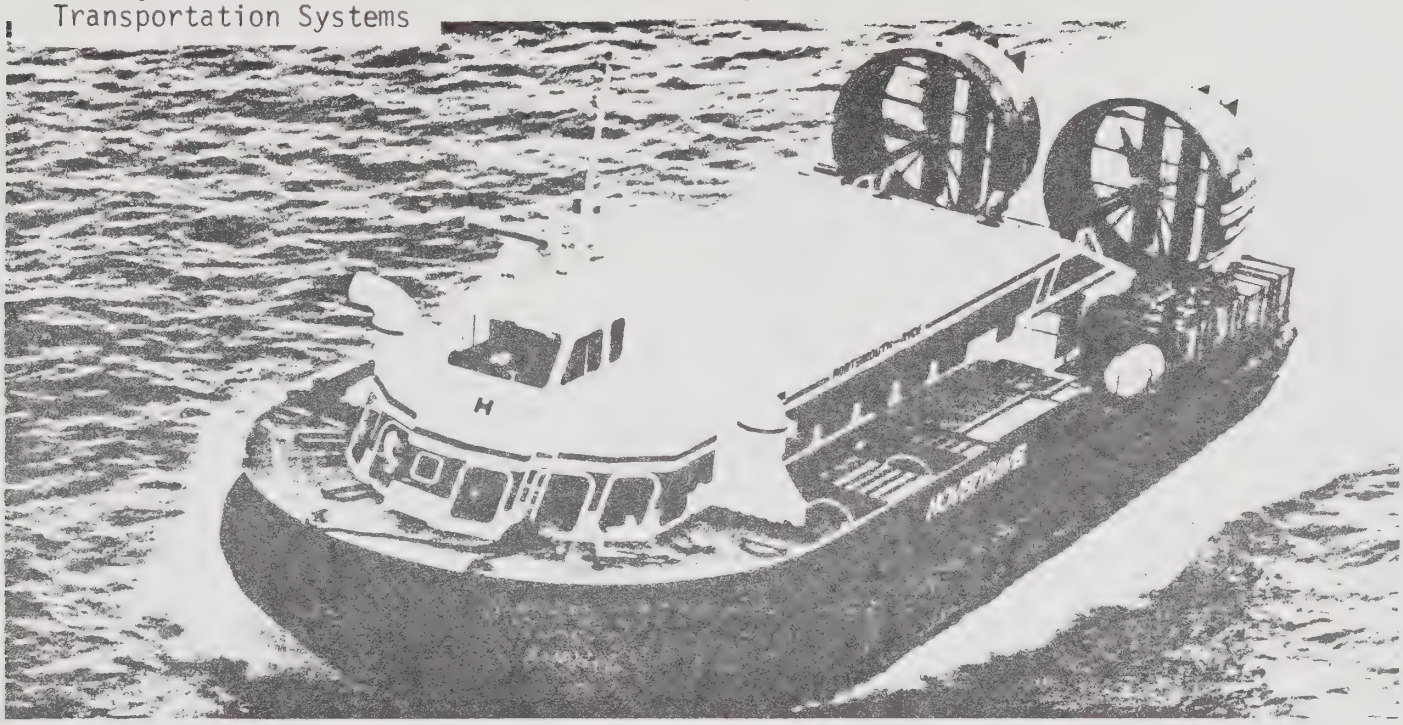






Craft Recommended by
Roumiguiere and Pacific
Transportation Systems

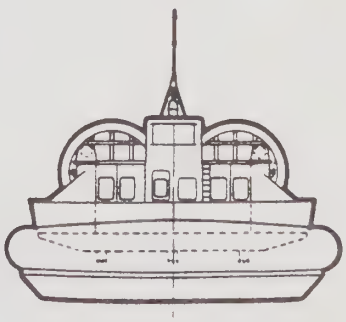
Exhibit 2



Model AP. 1-88 **AIR CUSHION VEHICLE (AMPHIBIOUS)**

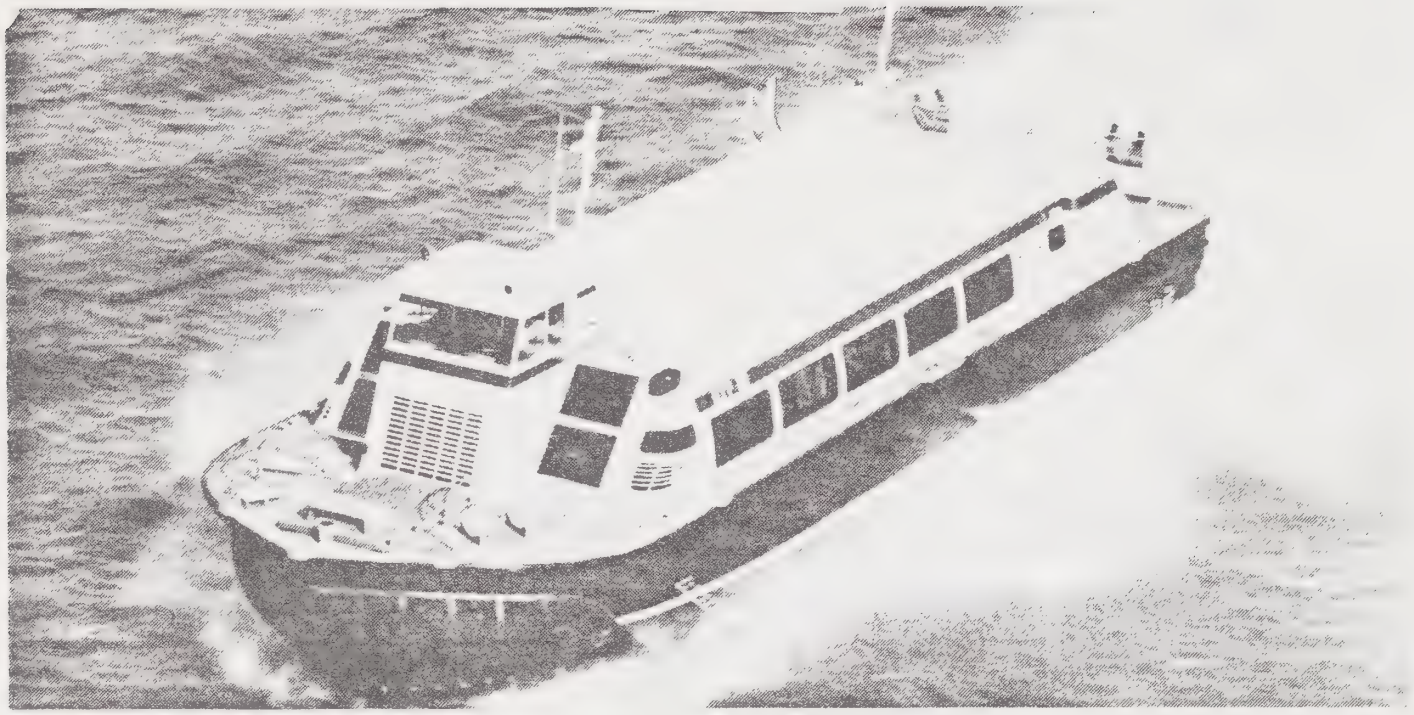
British Hovercraft Corporation, Cowes, I.O.W., England

Dimensions:		*Propulsion Plant:*	
Length, over all	77' 4"		2 × Deutz BF 12L413FC
Beam, Hull	32' 10"		air-cooled Marine Diesels
Draft, off cushion	N/A		2 × fixed pitch airscrew
Draft, on cushion	N/A		shrouded propellers
Displacement:	32.7 tons	*Lift Power Plant:*	
Gross Reg. Tonnage:	Not. Meas.		2 × Deutz BF 12L413FC
Speed, Maximum:	50 Kts		air-cooled Marine Diesels
Cruise:	40 Kts	*Electrical Plant:*	
Passenger Cap'y, Max:	94		4 x 28 volt DC generators,
Range:	100 NM		one per engine, belt driven



To be tested by
Harbor Bay Isle

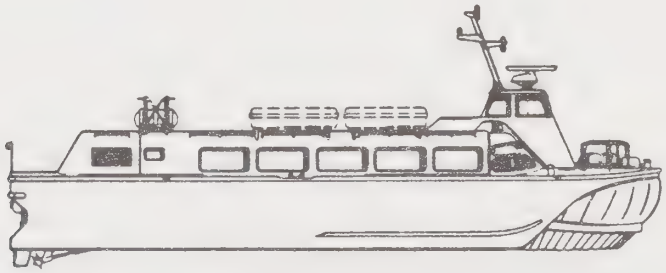
Exhibit 3

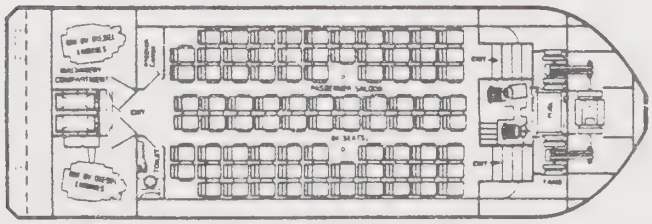


Model HM-218 **SURFACE EFFECT SHIP**

Vosper Hovermarine Ltd., Southhampton, England

Dimensions:		*Propulsion Plant:*	
Length, over all	60'		2 × General Motors type
Beam, Hull	20'		8V-92T1 Marine Diesels
Draft, off cushion	5' 7"		2 × fixed pitch propellers
Draft, on cushion	3' 6"		
Displacement:	25.5 tons	*Lift Power Plant:*	
Gross Reg. Tonnage:	51 tons		1 × Cummins type V555M
Speed, Maximum:	35 Kts		Marine Diesel
Cruise:	32 Kts	*Electrical Plant:*	
Passenger Cap'y, Max:	86		24 v. DC generators on
Range:	160 NM		each engine





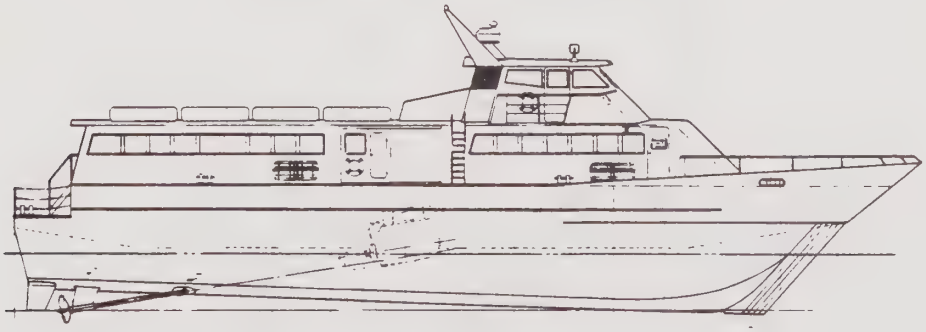
49 Passenger prototype built

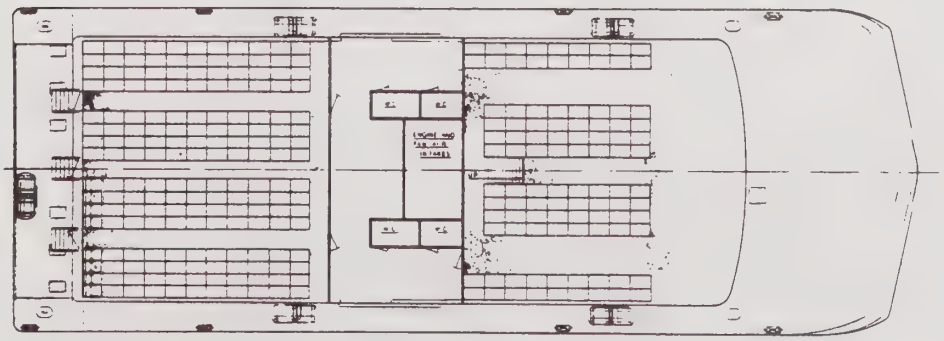
Exhibit 4

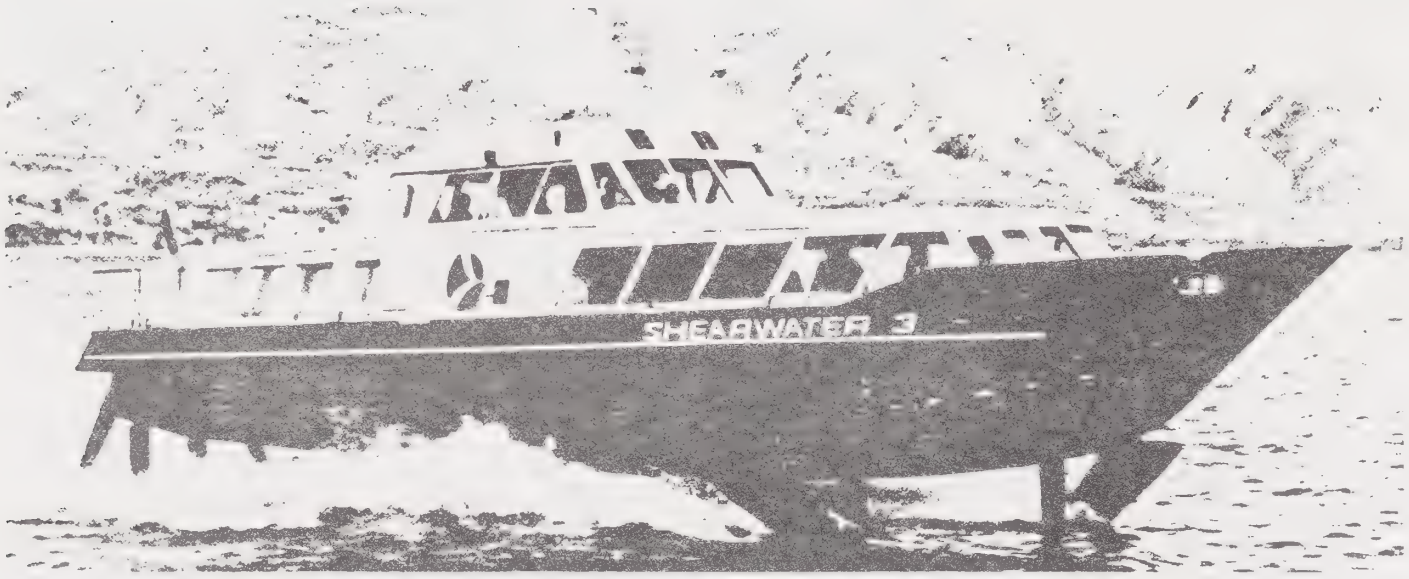
Model BH-340A **SURFACE EFFECT SHIP**

Bell Halter Inc., New Orleans, Louisiana

Dimensions:		*Propulsion Plant:*	
Length, over all	109'		2 × General Motors type
Beam, Hull	39'		16V-149T1 Marine Diesels
Draft, off cushion	8' 9"		2 × fixed pitch propellers
Draft, on cushion	6' 1"	*Lift Power Plant:*	
Displacement:	150 tons		2 × General Motors type
Gross Reg. Tonnage:	<100 tons		8V-92 Marine Diesels
Speed, Maximum:	33 Kts		
Cruise:	27 Kts	*Electrical Plant:*	
Passenger Cap'y, Max:	308		2 × 65 kVA diesel driven
Range:	360 NM		generators







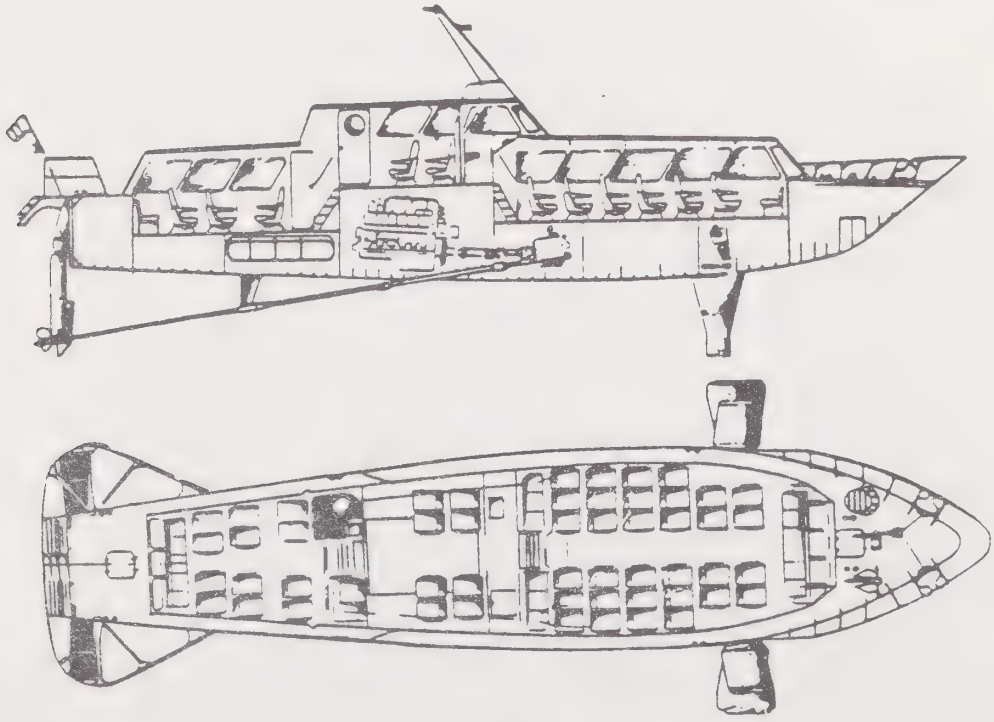
Model RHS-70 **SURFACE PIERCING HYDROFOIL**

Rodriquez Cantiere Navale, Messina, Sicily, Italy

Dimensions:	
Length, over all	72' 2"
Beam, Hull	15' 9"
Draft, off foils	8' 10"
Draft, on foils	3' 9"
Displacement:	31.5 tons
Gross. Reg. Tonnage:	69 tons
Speed, Maximum:	36.6 Kts
Cruise:	32.4 Kts
Passenger Cap'y, Max:	69
Range:	300 NM

Propulsion Plant:

1 × MTU MB 12V 331 TC82
Marine Diesel
1 × fixed pitch propeller



APPENDIX B

Documentation of Methodology Used to Estimate Patronage

Modal Split Model

The patronage for both the Sonoma/Marin and Pittsburg corridors was estimated using a simplified version of MTC's home based work mode choice model. The formulation of the model is shown in Exhibit B-1.

Input Variables

The MTC model uses a variety of input variables including number of persons per household, number of autos per worker, and household income. However, due to the time restraints and lack of data available at the appropriate aggregate level, the model was simplified and limited to the following input variables:

- In-vehicle travel time
- Out of vehicle travel time (walking and waiting)
- Cost

These variables are further defined in Exhibit B-2. In order to ensure the accuracy of the model, given the limitations of input variables, the model output was measured against observed mode splits based on 1980 Census Journey to Work data.

Patronage Analysis Process

The first step was to compute the probability of choosing transit using the existing transit utility.

The second step was to re-compute the utility derived from choosing transit using the input variables associated with HSWT. This new utility was then plugged into the model and the probability of using transit with HSWT as an option was computed.

The third step was to compare the results of steps one and two. If the implementation of HSWT resulted in an increase in the transit probability factor, then the percentage increase in transit probability was applied to the observed mode split percent. If not, the observed mode split percent was left unchanged.

The next step was to take these adjusted observed mode splits, and split the transit probability again between HSWT and other transit modes. This was done by applying the same model, but with the utilities computed for HSWT and other transit modes.

The final step taken was to multiply the probability of using HSWT as derived in the previous step and multiply it times the total demand for transit. For 1980, the transit demand was based on 1980 Census Journey to Work data. For the year 2000, the total transit demand was based on MTC's Year 2000 projections calculated by applying a FRATAR model to the 1980 Census data.

Exhibit B-1

Mode Choice Equations for Model

$$P = e^{UTR} \Big/ e^{UTR} + e^{UDA} + e^{USR}$$

Where: P = Probability of using transit

U = Utility derived from choosing a specific mode

TR = Transit

DA = Drive Alone

SR = Shared Ride

U = -0.02861* IVTT + -0.00422*Cost + -0.04738*OVTT

IVTT = in-vehicle travel time

OVTT = out-of-vehicle travel time

Exhibit B-2

Definition of Input Variables

IVTT

In-vehicle travel time from zone of production to zone of attraction (minutes, one way).

IVTT for drive alone is the in-vehicle travel time from the network plus the production end access terminal time plus attraction end access terminal time plus time to find parking terminal time.

IVTT for shared ride = drive alone IVTT plus 5 minutes pick-up penalty minus 10 minutes advantage for trips crossing the Bay Bridge during the morning commute. These have been determined to be trips made by workers living in Alameda, Contra Costa or Solano Counties who work in San Francisco County.

IVTT for transit includes only the linehaul in-vehicle travel time. For those trips requiring auto access to transit, the auto access time is added to the transit linehaul time.

COST

Total trip cost from zone of production to zone of attraction (one way in 1979 cents).

COST for drive alone = drive alone toll + drive alone parking cost per trip + auto operating cost.

For shared ride mode, COST = (drive alone toll + drive alone auto operating cost + drive alone parking cost)/2.293, the average shared ride occupancy.

COST for transit = transit fare + auto operating costs for trips requiring auto access to transit. A 13¢/mile is assumed for a vehicle accessing transit at 20 mph for the length of the auto connector.

OVTT

Out-of-vehicle travel time from zone I to zone J (one-way in minutes). For drive alone and shared ride, OVTT is the summation of walk to the vehicle at the production end and walk from the vehicle to the office at the attraction end.

For transit, OVTT includes walk to bus or rail at production end plus first wait plus transfer waits plus walk to the office at the attraction end.